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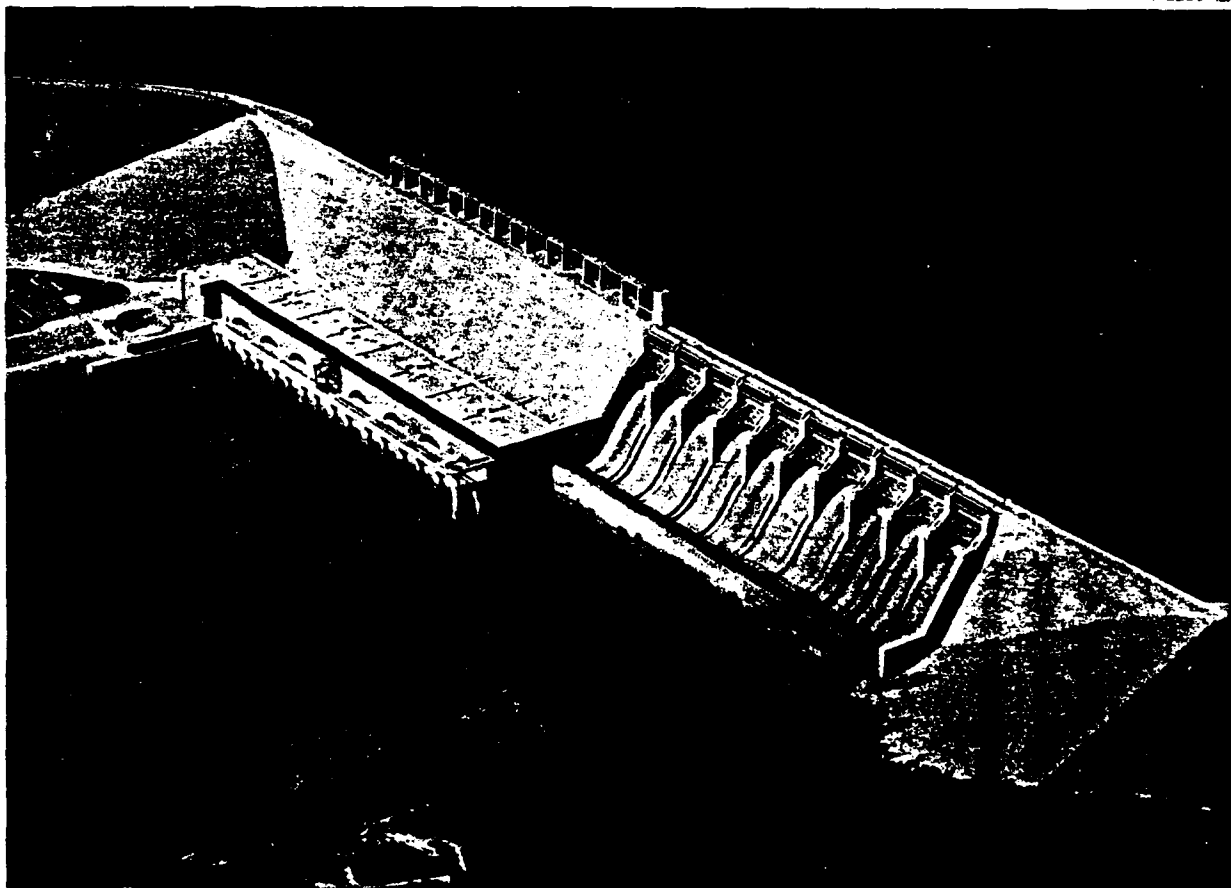
Richard B. Russell Dam and Lake

Savannah River, Georgia And South Carolina

Final Foundation Report Volume 2 of 2

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Overview Of Richard B. Russell Dam And Powerhouse



US Army Corps
of Engineers
Savannah District

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RICHARD B. RUSSELL PROJECT
SAVANNAH RIVER, GEORGIA AND SOUTH CAROLINA
FINAL FOUNDATION REPORT
CONCRETE DAM, EMBANKMENTS, AND POWERHOUSE

In Two Volumes

VOLUME II - APPENDICES



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U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

APPENDICES

(Volume II)

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APPENDIX A

ROCK TESTING DATA

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC CORPS OF ENGINEERS MARIETTA, GEORGIA			DISTRICT Savannah PROJECT Trotters Shoals CONTRACT NO.	
GENERAL TEST REPORT (ROCK CORES)			DATE REPORTED 15 Sept. 1970 WORK ORDER NO. 6531 REQN. NO. SAS-ENG-TROT-15 BASE UNIT COST DATE SAMPLE RECEIVED 9-8-70 LAB NO. See below	
DESCRIPTION NX Rock Cores			FOR USE AS:	
SOURCE Job Site			TESTED FOR: Sonic Velocity	
<input type="checkbox"/> MEETS SPECIFICATIONS			<input type="checkbox"/> FAILS SPECIFICATIONS (See below)	
<u>Lab. No.</u>	<u>Hole No.</u>	Sonic * Velocity <u>fps</u>	<u>Remarks</u>	
1M2662	C-152	16,640	Cataclastic textured. There are no apparent defects in the rock. Sample is similar to sample from Hole C-191.	
1M2663	C-153	12,470	Granitic (interlocking) textured. Sample contained numerous horizontal and steeply dipping well healed fractures.	
1M2664	C-154	15,180	Granitic (interlocking) textured. Sample contained several steeply dipping well healed fractures. Fractures are not as numerous as in sample C-153 and are calcite filled.	
1M2665	C-164	15,110	Primarily cataclastic textured. A vertical calcite healed fracture separates material similar to sample C-152 from more basic material. Basic material approximates 25% of rock. There are some horizontal to steeply dipping well healed calcite filled fractures.	
REMARKS: *Tests performed by Law Engineering Testing Co., Atlanta, Georgia.				
REPORTED BY:		TESTED BY *		CHECKED BY GVJ
DATE:		SAMPLED BY		



LAW ENGINEERING TESTING COMPANY

Geotechnical and Materials Engineers

412 PLASTERS AVENUE, N.E. / ATLANTA, GEORGIA 30324 / (404) 873-4761

August 31, 1970

Client: Department of the Army
South Atlantic Division Laboratory
Corps of Engineers
611 South Cobb Drive (Ga. Hwy. 230)
Marietta, Georgia 30060

Subject: Pulse Velocity Tests on
Rock Cores

Our Job Number: E-1435

Date of Testing: August 31, 1970

On the above date pulse velocity tests were performed on ten (10) rock core samples submitted by your laboratory. The following table lists the samples tested and the results of those tests.

Sample Number	Length		Time	Velocity (fps)
	Inches	Feet	Microsecond	
C-191 (3)	11.783	0.9819	52	18,800
C-130	12.054	1.0045	46.5	21,600
C-192 (3)	12.043	1.0035	82.5	12,100
C-127	12.017	1.0014	51	19,600
C-129	11.814	0.9845	82	12,000
C-146	12.028	1.0023	55.5	18,000
C-189 (4)	12.116	1.0096	66	15,200
C-189 (1)	12.063	1.00525	67	15,000
C-202 (3)	12.014	1.00116	68	14,700
C-190 (3)	12.034	1.0070	70.5	14,300

Trotter Shells

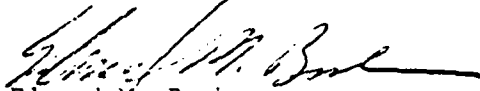
Overhead

Note: Lengths measured by SADL.

It was our pleasure to furnish you with this service and if we can be of any further assistance please do not hesitate to contact this office.

Respectfully submitted,

LAW ENGINEERING TESTING COMPANY



Edward M. Beck
Manager Non-destructive Testing Department

- 6) Department of the Army, SAD Laboratory
Corps of Engineers

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC CORPS OF ENGINEERS MARIETTA, GEORGIA					DISTRICT Savannah	
GENERAL TEST REPORT (ROCK CORES)					PROJECT Trotters Shoals Dam	
					CONTRACT NO.	
					DATE REPORTED 23 July 1970	
					WORK ORDER NO. 6401	
DESCRIPTION Six NX and one 1 7/8 in. Dia. Rock Cores					REQN. NO. SAS-ENG-TROT-11	
SOURCE Job Site					BASE UNIT COST	
FOR USE AS:					DATE SAMPLE RECEIVED 5-13-70	
TESTED FOR: Direct Shear Strength of Rock & Conc. on Rock & Coef. of Sliding Friction of Rock on Rock & Conc. on Rock					LAB NO. See below	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <input type="checkbox"/> MEETS SPECIFICATIONS </div> <div style="text-align: center;"> <input type="checkbox"/> FAILS SPECIFICATIONS (See below) </div> </div>						
<u>Lab. No.</u>	<u>Hole No.</u>	<u>Normal Load PSF</u>	<u>Direct Shear Strength - PSI</u>		<u>Coefficient of Sliding Friction (Sliding Load/Normal Load)</u>	
			<u>Rock</u>	<u>Concrete on Rock*</u>	<u>Rock on Rock**</u>	<u>Concrete on Rock</u>
1M2512	C-146	5,000	3,590	440	1.67	1.27
1M2513	C-130	10,000	3,250	200	1.51	1.15
1M2514	C-7	13,000	4,075	152	1.49	--
1M2515	C-129	4,000	2,180	165	3.61	--
1M2516	C-29	9,000	3,190	90	1.37	--
1M2517	C-132	12,000	2,390	265	3.08	--
1M2518	C-144	20,000	2,115	134	0.98	1.08
REMARKS: *Concrete cast against broken faces and cured 7 days. **Samples tended to "ride-up" on the high points as sliding progressed. There was no evidence of shear but some surface abrasion did occur. See the continuation sheet for a detailed description of the joints before testing.						
REPORTED BY: <input type="checkbox"/> PHONE <input type="checkbox"/> WIRE			TESTED BY HLM		CHECKED BY GVJ	
DATE: _____			SAMPLED BY			

GENERAL TEST REPORT (Continued)

(ROCK CORES)Lab. No. See belowDate 23 July 1970

<u>Lab. No.</u>	<u>Hole No.</u>	<u>Description of Sliding Friction "Rock on Rock" Joint</u>
1M2512	C-146	Dip angle 15°; rough undulating surface across fine grained interlocking granular textured rock. Limonite stains indicate slight weathering.
1M2513	C-130	Dip angle 5°; rough undulating surface across medium to coarse grained interlocking granular textured rock. Fresh surface.
1M2514	C-7	Dip angle 5°; plane smooth surface. Fine uniform textured grain. Fresh surface appears to line up along a schistose plane.
1M2515	C-129	Dip angle 5°; rough undulating surface across medium to coarse grained rock. Limonite stains indicate slight weathering.
1M2516	C-29	Dip angle 15°; plane smooth surface across fine grained crystalline calcite of low hardness and strength. Fresh surface.
1M2517	C-132	Dip angle 5°; rough undulating surface across medium to coarse grained interlocking granular textured rock. Fresh surface.
1M2518	C-144	Dip angle 10°; rough plane surface, moderately to highly weathered along fractured surface with extensive development of limonite on exposed surface. Fine grained weathered rock.

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC CORPS OF ENGINEERS MARIETTA, GEORGIA					DISTRICT Savannah	
					PROJECT Trotters Shoals	
					CONTRACT NO.	
GENERAL TEST REPORT (ROCK CORES)					DATE REPORTED 23 July 1970	
					WORK ORDER NO. 6401	
DESCRIPTION Six NX and one 1 7/8 in. Dia. Rock Cores					REQN. NO. SAS-ENG-TROT-11	
SOURCE Job Site					BASE UNIT COST	
FOR USE AS:					DATE SAMPLE RECEIVED 5-13-70	
TESTED FOR: Specific Gravity, Unconfined Compressive Strength, Poissons Ratio, Static and Dynamic Modulus of Elasticity					LAB NO. See below	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <input checked="" type="checkbox"/> MEETS SPECIFICATIONS </div> <div style="text-align: center;"> <input type="checkbox"/> FAILS SPECIFICATIONS (See below) </div> </div>						
<u>Lab No.</u>	<u>Hole No.</u>	<u>Bulk Specific Gravity</u>	<u>Unconfined Compressive Strength PSI (H/D = 2)</u>	<u>Poissons Ratio</u>	<u>Modulus of Elasticity</u> <u>PSI X 10⁶</u> <div style="display: flex; justify-content: space-between;"> <u>Static (Initial Tangent)</u> <u>Dynamic</u> </div>	
1M2512	C-146	2.94	23,550	0.29	7.14	0.54*
1M2513	C-130	2.70	26,720	0.24	5.20	5.78
1M2514	C-7	3.04	10,960	0.21	12.90	0.40*
1M2515	C-129	2.70	31,940	0.30	5.20	7.43
1M2516	C-29	3.02	25,930	0.25	13.79	1.05*
1M2517	C-132	2.70	34,350	0.25	3.18	3.90
1M2518	C-144	2.72	16,540	0.21	5.97	0.24*
REMARKS: *Sample contained healed fractures which probably interfered with frequency reading.						
REPORTED BY: <input type="checkbox"/> PHONE <input type="checkbox"/> WIRE DATE: _____				TESTED BY <div style="text-align: center;">JWL, HLM</div> CHECKED BY <div style="text-align: center;">GVJ</div>		
				SAMPLED BY		

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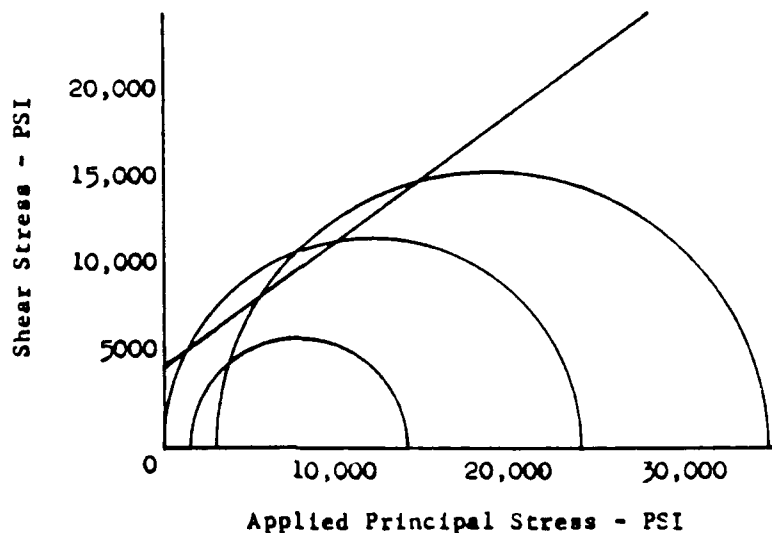
Reqn. No. SAS-ENG-TROT-11
W. O. No. 6401

Trotters Shoals Dam - Savannah District

TRIAXIAL TEST DATA

Lab. No. 1M2512, Hole No. C-146, Depth 20.5' - 22.2'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	23,550	12,280	31,130
Angle of Internal Friction 36°			
Shear Stress Intercept: 4600 psi			



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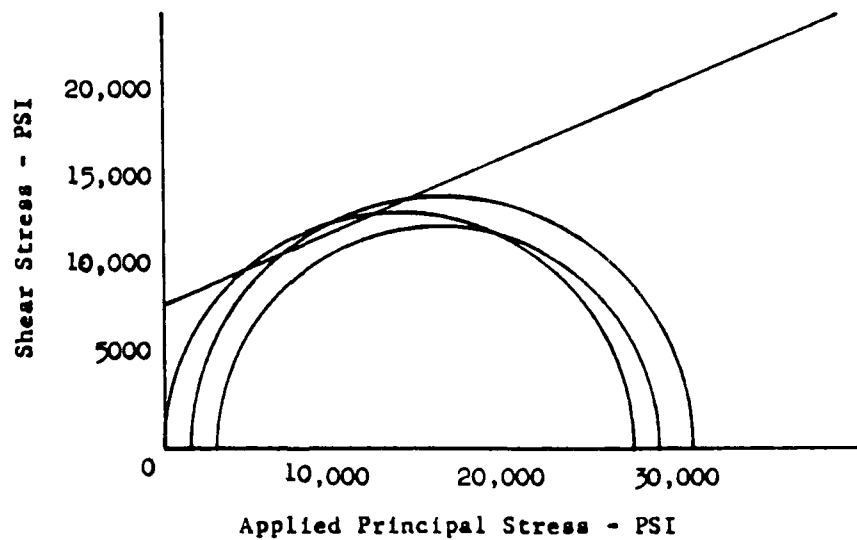
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W. O. No. 6401

Trotters Shoals Dam - Savannah District

TRIAXIAL TEST DATA

Lab. No. 1M2513, Hole No. C-130, Depth 27.3' - 29.4'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	26,720	28,740	25,130
Angle of Internal Friction: 23°			
Shear Stress Intercept: 8300 psi			



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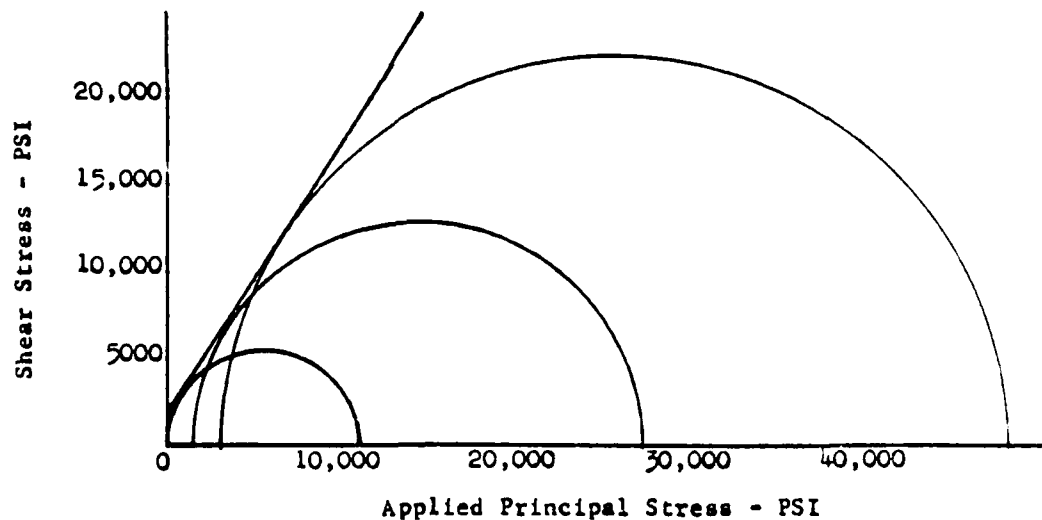
W. O. No. 6401

Trotters Shoals Dam - Savannah District

TRIAXIAL TEST DATA

Lab. No. LM2514, Hole No. C-7, Depth 34.5' - 36.3'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	10,960	25,570	45,040
Angle of Internal Friction: 58°			
Shear Stress Intercept: 2000 psi			



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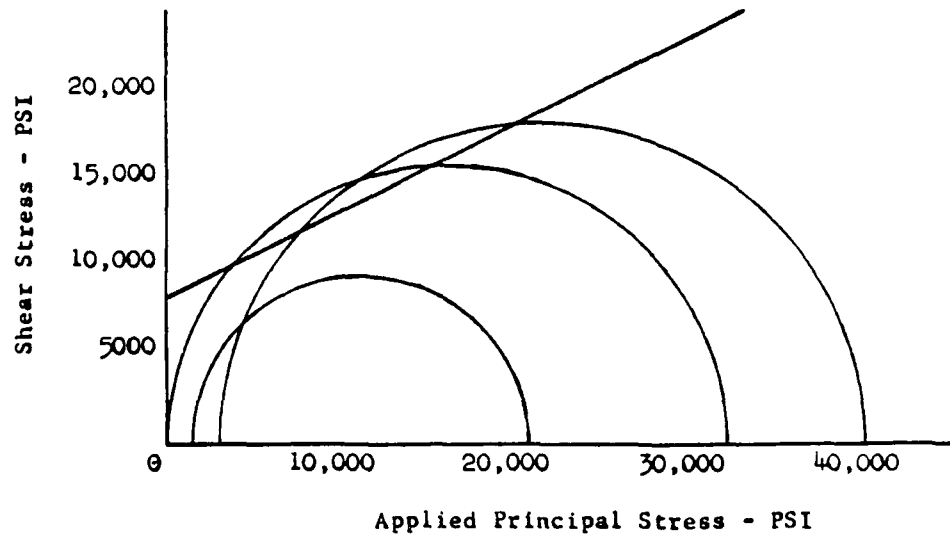
Reqn. No. SAS-ENG-TROT-11
W. O. No. 6401

Trotters Sheals Dam - Savannah District

TRIAXIAL TEST DATA

Lab. No. 1M2515, Hole No. C-129, Depth 12.9' - 15.5'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	31,940	19,010	36,780
Angle of Internal Friction: 26°			
Shear Stress Intercept: 8500 psi			



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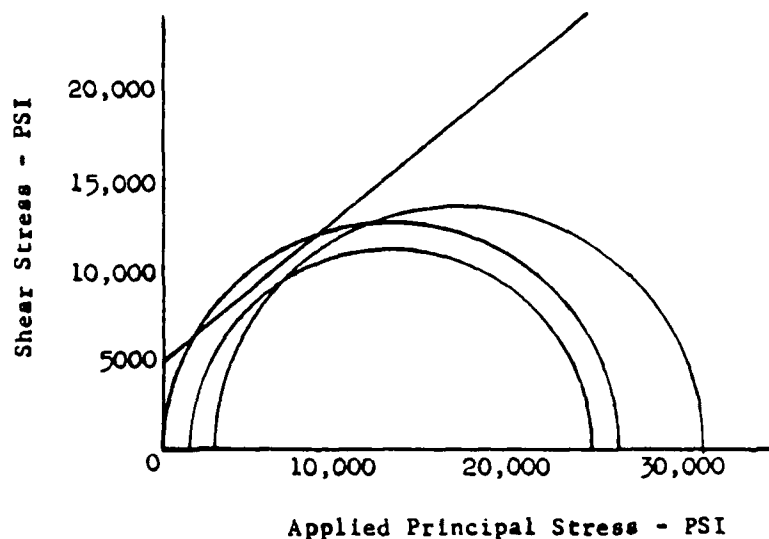
W. O. No. 6401

Trotters Shoals Dam - Savannah District

TRIAXIAL TEST DATA

Lab. No. 1M2516, Hole No. C-29, Depth 37.7' - 39.8'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	25,930	23,090	27,690
Angle of Internal Friction: 40°			
Shear Stress Intercept: 5000 psi			



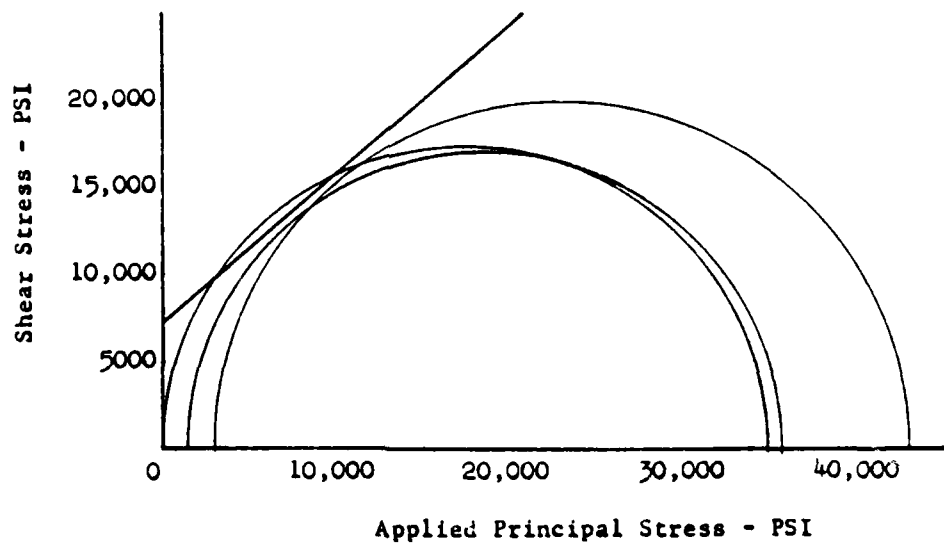
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Reqn. No. SAS-ENG-TROT-11
W. O. No. 6401

Trotters Shoals Dam - Savannah District
TRIAXIAL TEST DATA

Lab. No. 1M2517, Hole No. C-132, Depth 28.4' - 30.9'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	34,350	33,620	39,400
Angle of Internal Friction: 41°			
Shear Stress Intercept: 7300 psi			



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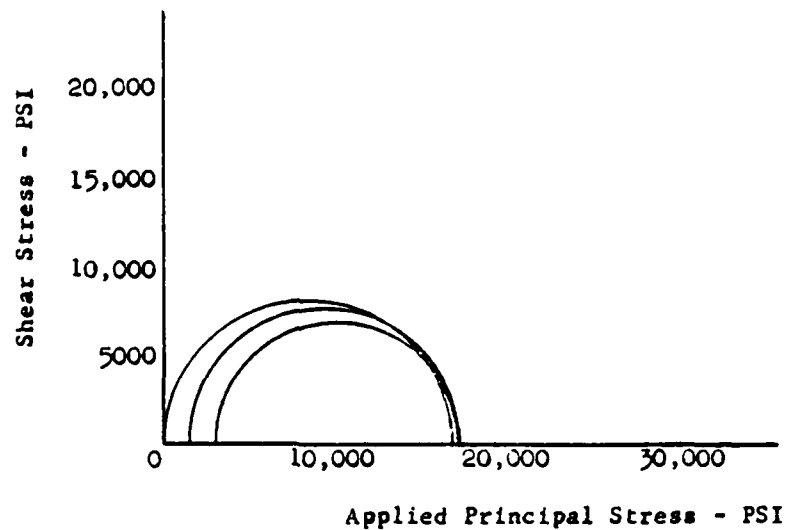
Reqn. No. SAS-ENG-TROT-11
W. O. No. 6401

Trotters Shoals Dam - Savannah District
TRIAXIAL TEST DATA

Lab. No. 1M2518, Hole No. C-144, Depth 36.8' - 38.5'

Min. Principal Stress (Confining Pressure) PSI:	0	1500	3000
Max. Principal Stress, PSI:	16,540	15,390	13,000
Angle of Internal Friction:			
Shear Stress Intercept:			

Note: Lack of correlation between samples probably
due to the variable strength of the steeply
dipping fractures present in the rock.

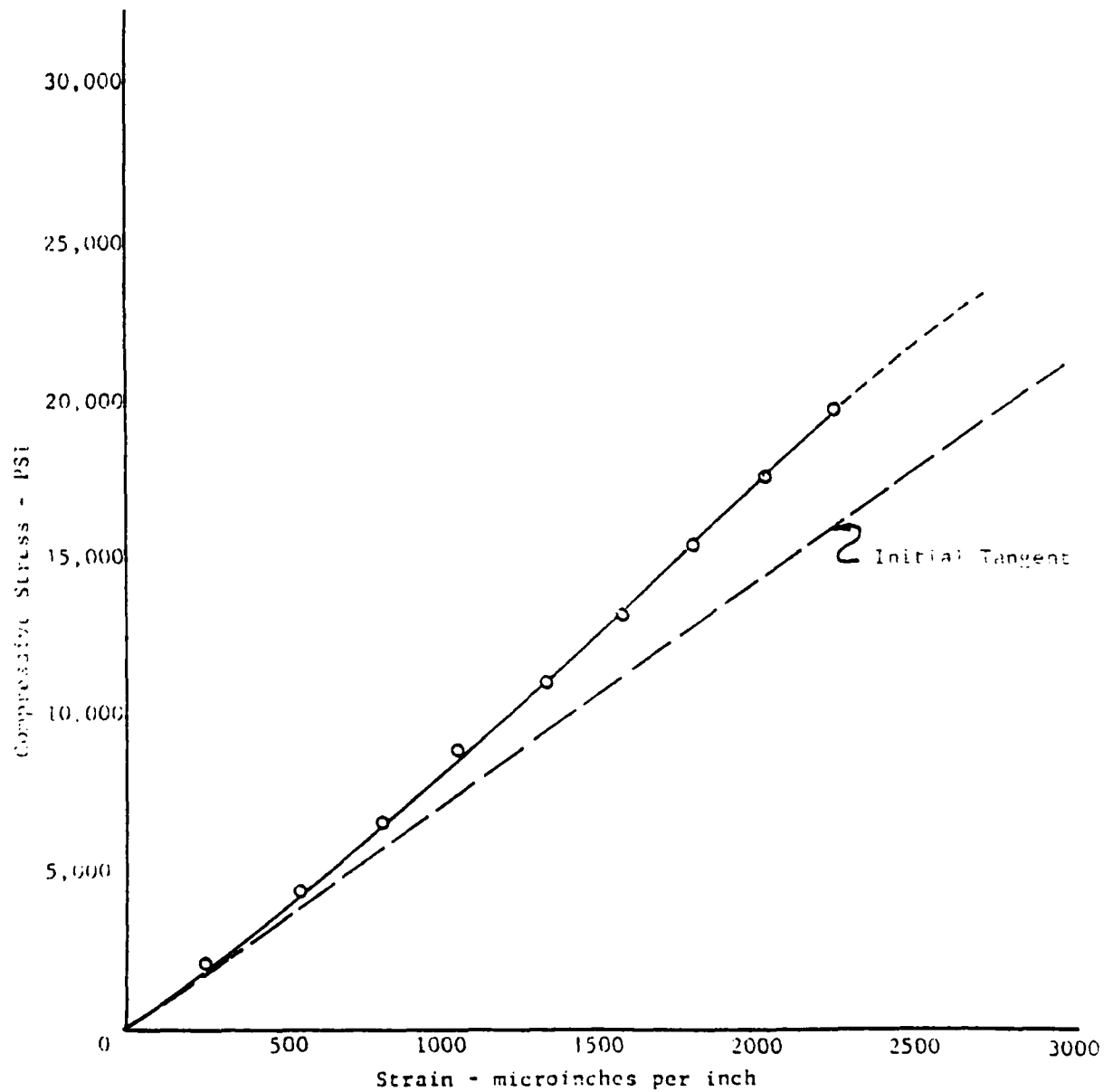


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MARIETTA, GEORGIA

Req. No. SAS-ENG-TROT-11
Work Order No. 6401

Trotters Shoals Dam - Savannah District
Stress-Strain Curve

Lab No. 1M2512, Hole No. C-146, Depth 20.5' - 22.2'

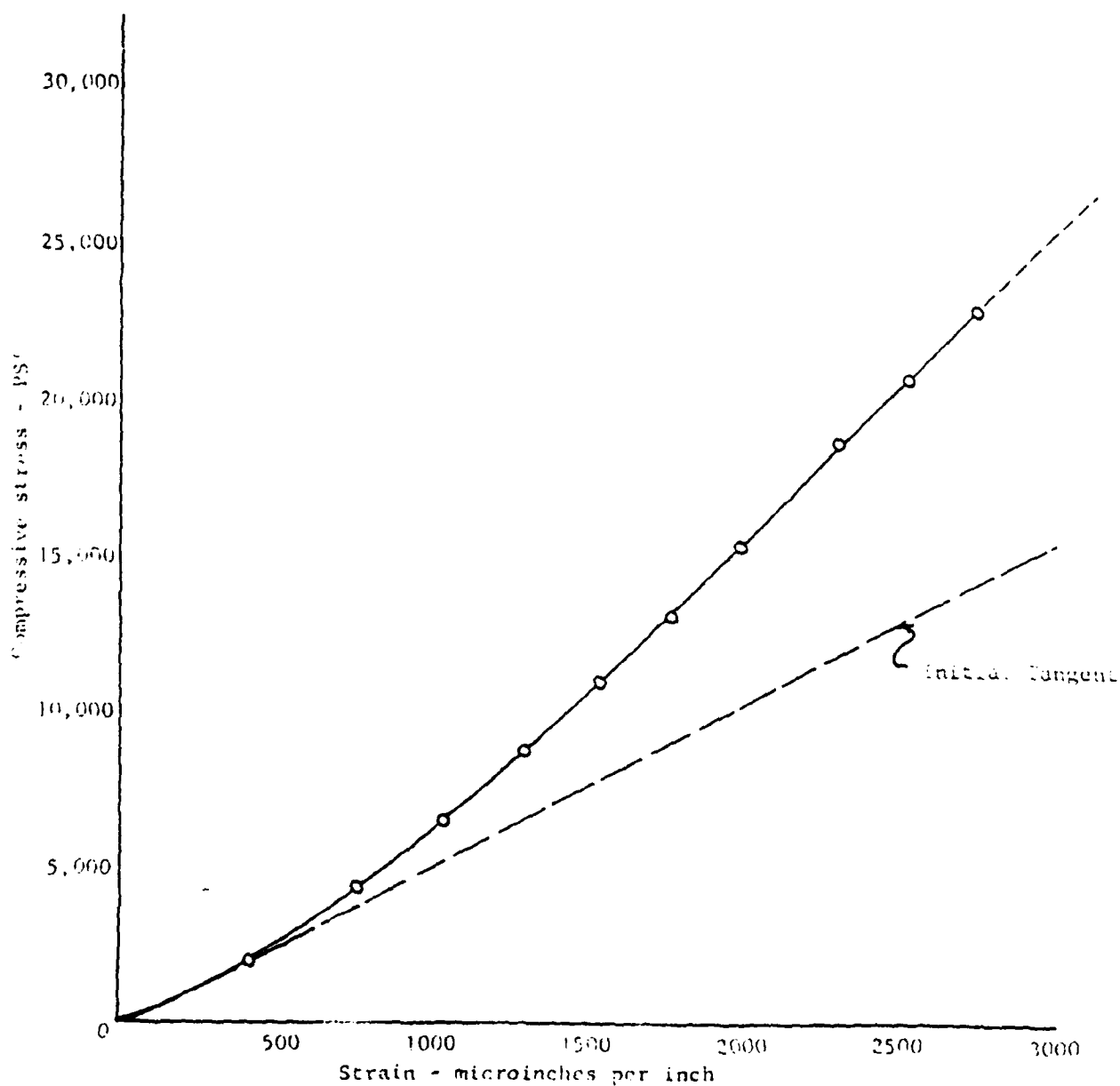


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MARIETTA, GEORGIA

Req. No. SAS-ENG-TROT-11
Work Order No. 6401

Trotters Shoals Dam - Savannah District
Stress-Strain Curve

Lab No. 1M2513, Hole No. C-130, Depth 27.3' - 29.4'

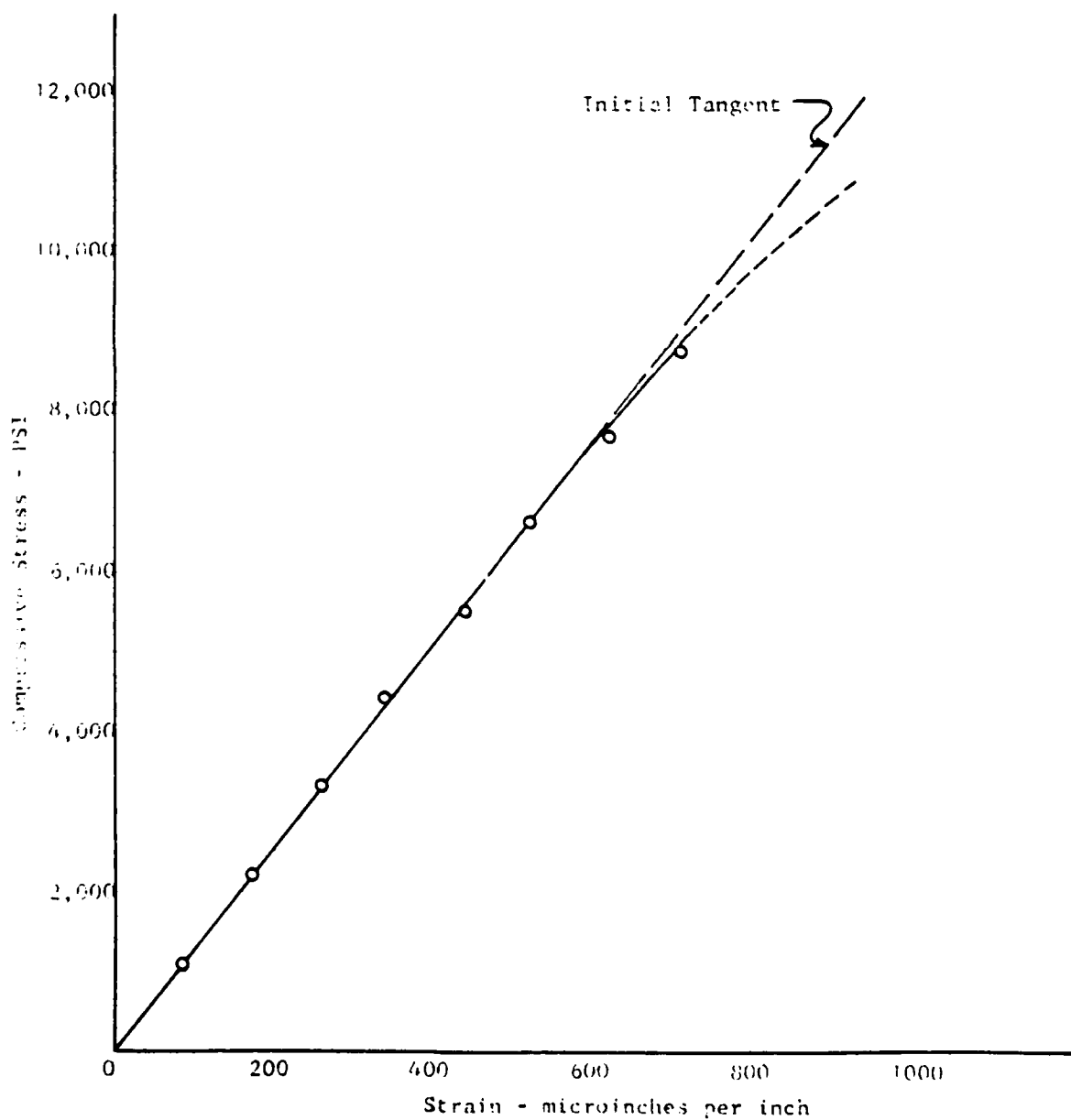


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MARIETTA, GEORGIA

Reqn. No. SAS-ENG-TROT-11
Work Order No. 6401

Trotters Shoals Dam - Savannah District
Stress-Strain Curve

Lab No. 1M2514, Hole No. C-7, Depth 34.5' - 36.3'

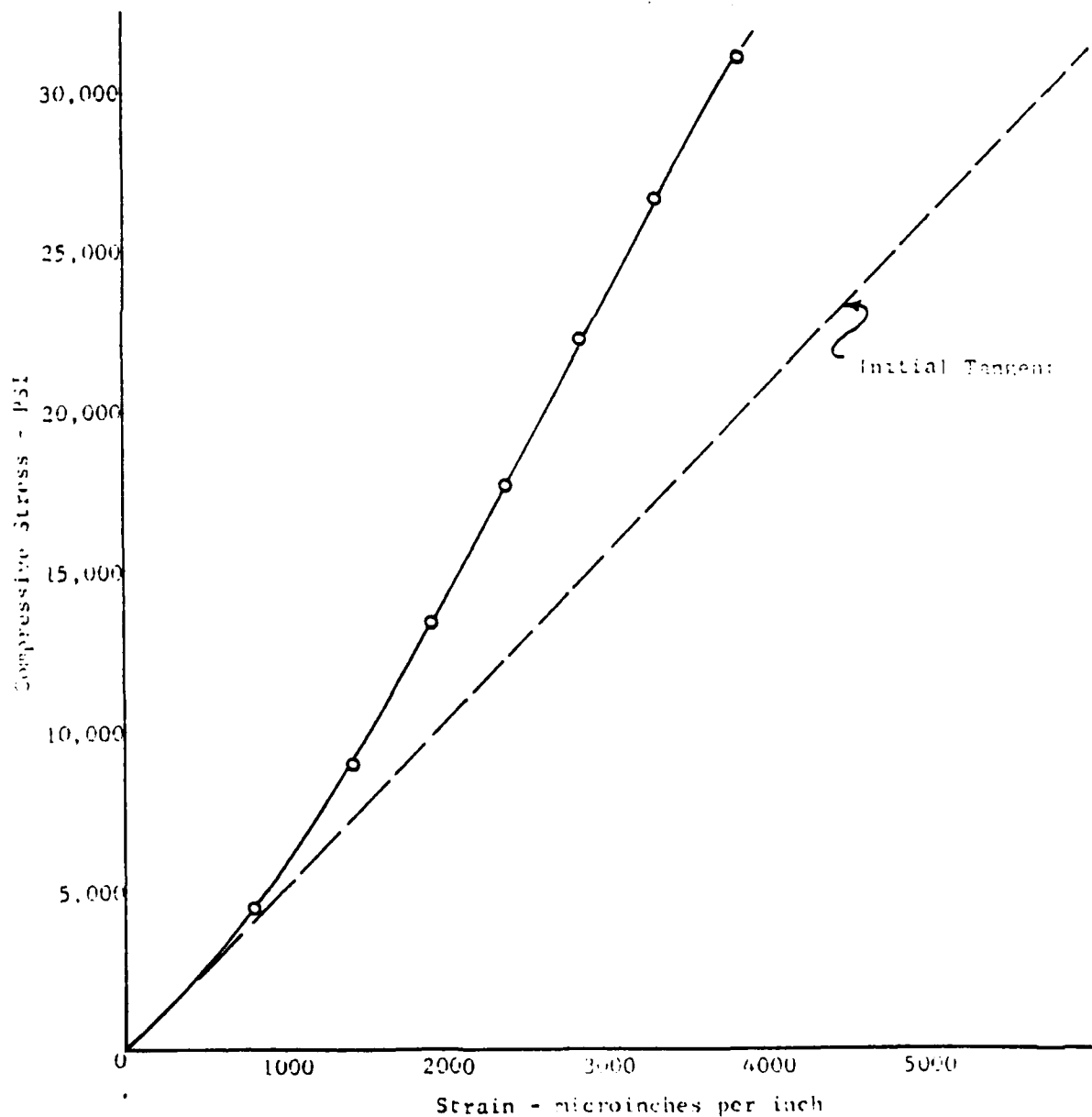


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MARIETTA, GEORGIA

Reqn. No. SAS-ENG-TROT-11
Work Order No. 6401

Trotters Shoals Dam - Savannah District
Stress-Strain Curve

Lab No. 1M2515, Hole No. C-129, Depth 12.9' - 15.5'

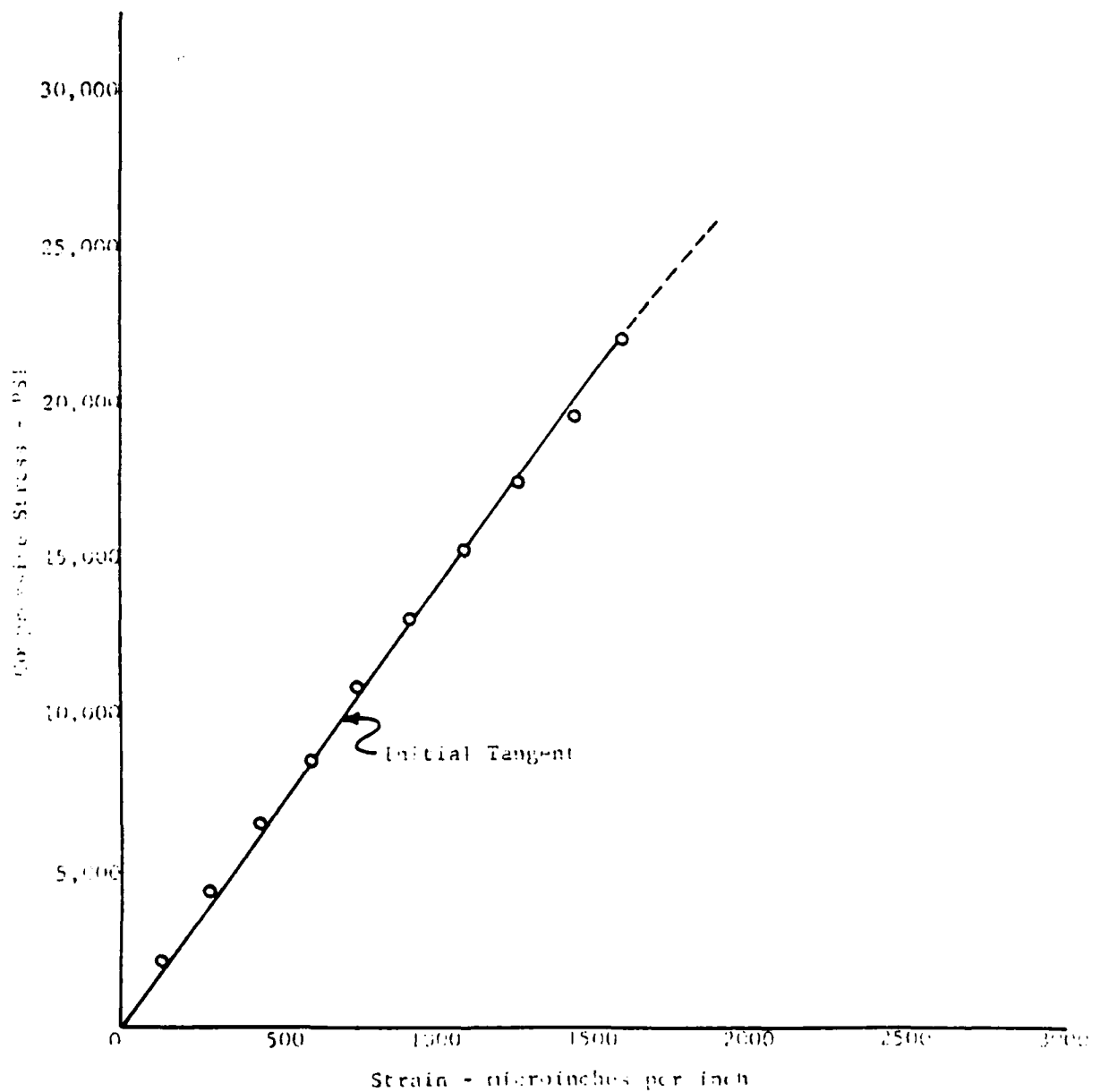


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Req. No. GAS-ENG-TMCT-11
Work Order No. 6401

Trotters Shoals Dam - Savannah District
Stress-Strain Curve

Lab No. M2516, Hole No. C-29, Depth 37.7' - 39.8'



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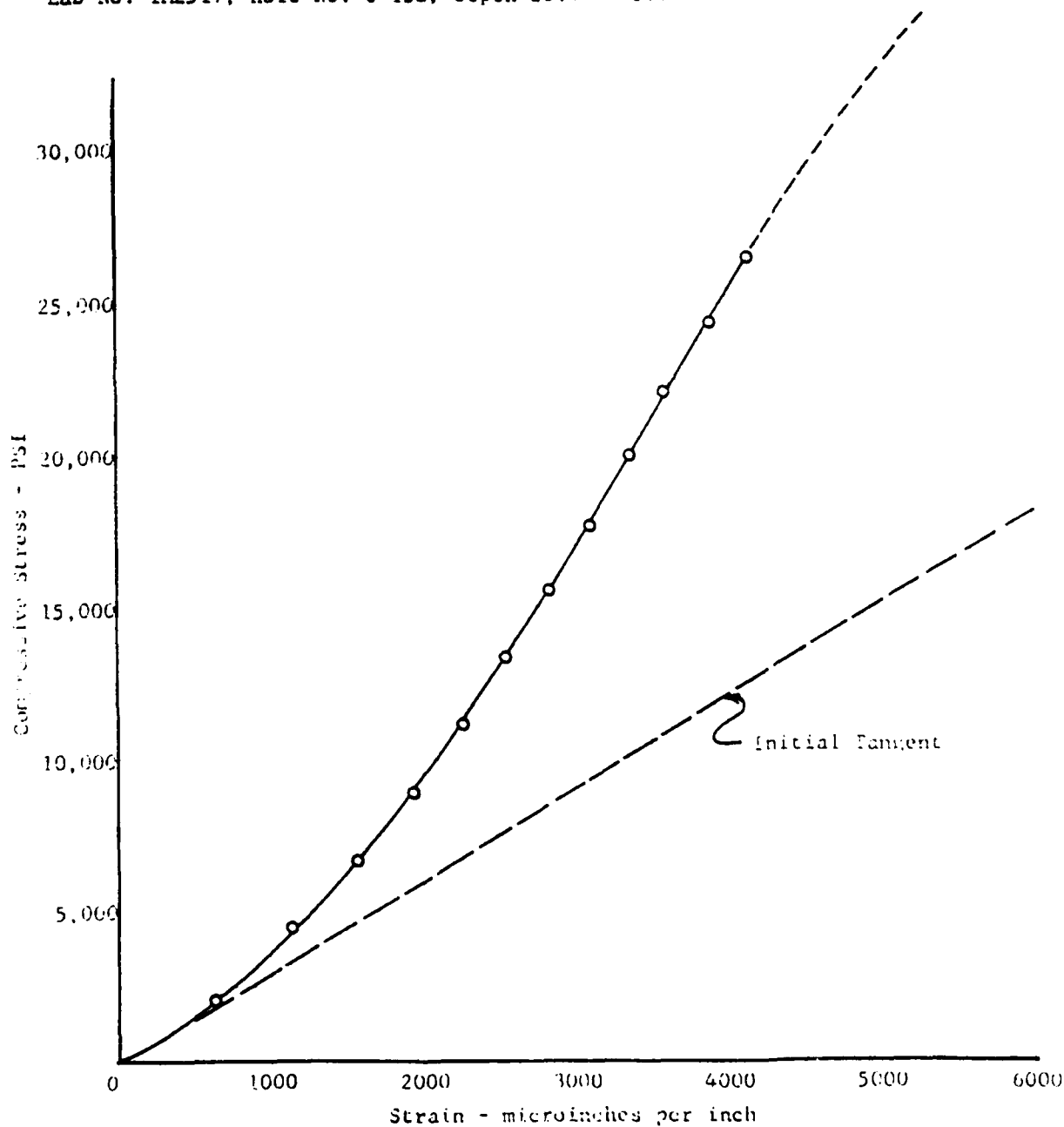
Req. No. SAS-ENG-TROT-11

Work Order No. 6401

TROTTERS SHOALS DAM - Savannah District

Stress-Strain Curve

Lab No. 1M2517, Hole No. C-132, Depth 28.4' - 30.8'



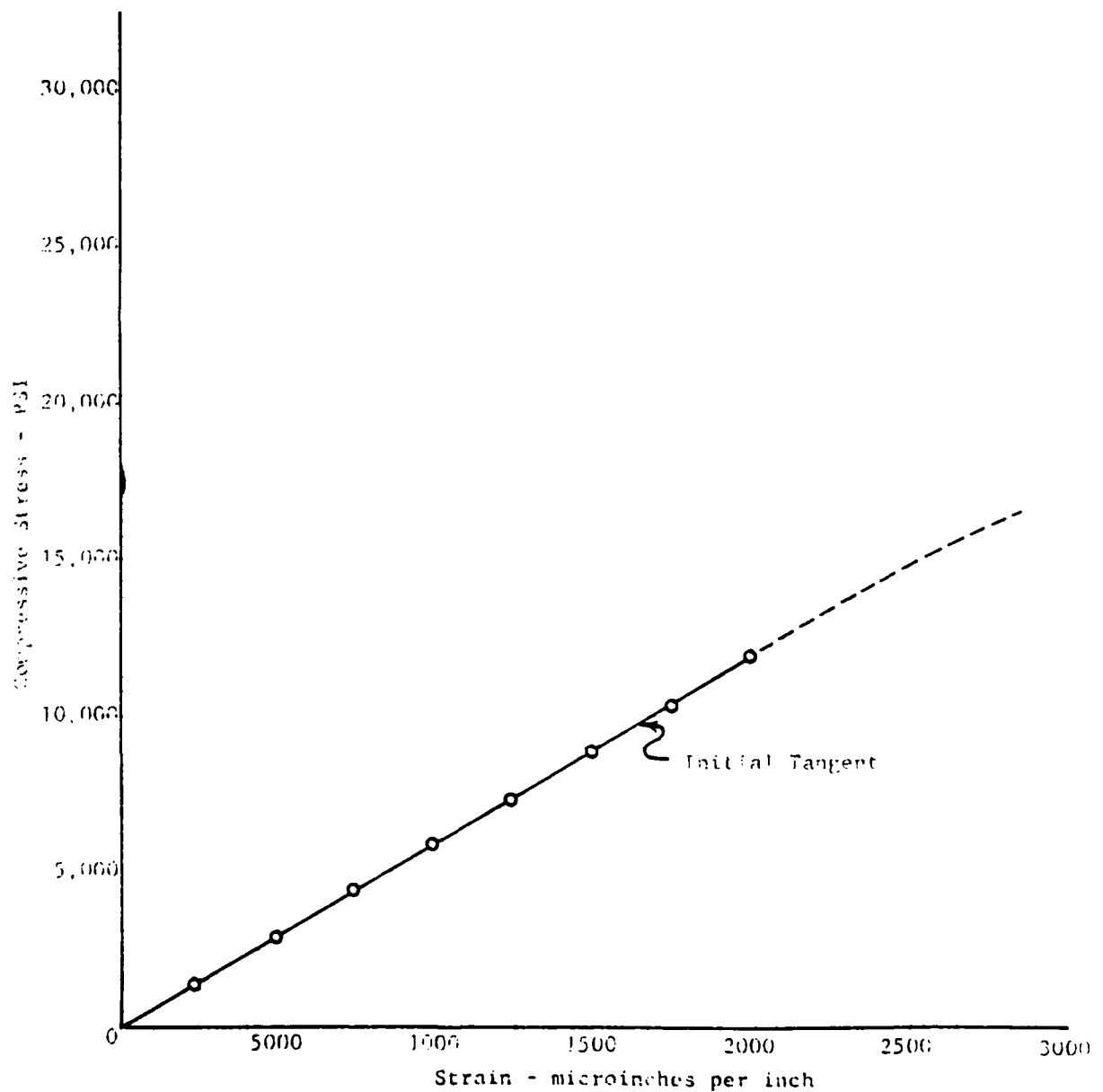
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MARIETTA, GEORGIA

Reqn. No. SAS-ENG-TROT-11
Work Order No. 6401

Trotters Shoals Dam - Savannah District

Stress-Strain Curve

Lab No. 1N2518, Hole No. C-144, Depth 36.8' - 38.5'



APPENDIX B

RICHARD B. RUSSELL - PUMPING RECORDS

APPENDIX B

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
1-08-78			Weedend			
1-09-78	Acc. over W/E 1.10	2	6,390,000	72.17	1,476	1,476
1-10-78	0	2	2,202,000	24.17	1,518	1,529
1-11-78	0	2	1,464,000	24.25	1,006	1,016
1-12-78	.42	2	1,903,000	23.17	1,369	1,322
1-13-78						
1-14-78			Weekend			
1-15-78			Weekend			
1-16-78	W/E 0.60	1	4,734,000	96.16	320	322
1-17-78	0.56	1/2 Day Shutdown				
1-18-78	0.03	3	3,456,000	36	1,600	1,200
1-19-78	1.29					
1-20-78		3	12,105,000	47.83	4,218	4,203
1-21-78						
1-22-78						
1-23-78		2	5,927,000	71.7	1,377	1,372
1-24-78	1.55	2	1,513,000	24.1	1,046	1,051
1-25-78	1.31					
1-26-78		3	7,651,500	47.9	2,660	2,655
1-27-78		3	4,087,500	24.25	2,809	2,839

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
1-28-78						
1-29-78						
1-30-78		3	6,516,000	71.15	1,526	1,508
1-31-78						
2-1-78	0.15	2	3,249,000	48.40	1,118	1,128
2-2-78		2	1,970,000	24.33	1,349	1,368
2-3-78		2	1,778,000	23.80	1,243	1,235
2-4-78						
2-5-78						
2-6-78		2	4,871,000	71.70	1,132	1,123
2-7-78		2	1,416,000	24.80	952	983
2-8-78	Trace Snow	2	1,500,000	23.72	1,054	1,042
2-9-78		2	1,481,000	23.78	1,038	1,028
2-10-78		2	1,614,000	23.00	1,170	1,121
2-11-78						
2-12-78						
2-13-78	0.23					
2-14-78		2	6,273,000	121.1	863	871
2-15-78		2	1,517,000	24.16	1,046	1,053
2-16-78	0.02	2	1,507,000	23.77	1,057	1,047

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
2-17-78						
2-18-78						
2-19-78						
2-20-78		2	5,793,000	96.11	1,005	1,006
2-21-78	Snow 0.03	2	1,283,000	23.62	905	921
2-22-78		2	1,466,000	24.33	1,004	1,018
2-23-78		2	1,403,000	23.76	988	974
2-24-78		2	1,480,000	24.22	1,018	1,023
2-25-78						
2-26-78						
2-27-78	0.13					
2-28-78	0.22	2	5,250,000	96.03	911	911
3-1-78		2	1,400,000	24.12	967	972
3-2-78	0.55	2	1,345,000	23.75	944	934
3-3-78		2	1,605,000	22.97	1,165	1,115
3-4-78						
3-5-78						
3-6-78		2	4,056,000	71.75	942	930
3-7-78	0.27	2	1,448,000	25.00	965	1,006
3-8-78	0.17	2	1,422,000	24.50	967	988

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
3-9-78	1.25					
3-10-78	Weekend	2	3,491,000	47.5	1,225	1,212
3-11-78	Weekend	2	1,352,000	22.0	1,024	939
3-12-78	.10					
3-13-78	0	2	3,239,000	49.0	1,102	1,125
3-14-78	.12	2	1,329,000	25.25	877	922
3-15-78	0	2	904,000	23.75	634	628
3-16-78	0	2	868,000	24.25	597	602
3-17-78	0	2	946,000	24.0	657	657
3-18-78	0	2	424,000	20.5	345	294
3-19-78	0					
3-20-78	0	2	3,670,000	50.75	1,295	1,274
3-21-78	0	2	1,540,000	24.25	1,058	1,060
3-22-78	0	2	666,000	25.0	444	462
3-23-78	0	2	1,723,000	22.6	1,271	1,197
3-24-78	.25	2	1,421,000	25.0	947	987
3-25-78	.46	2	1,356,000	22.8	991	942
3-26-78	0					
3-27-78	0	2	2,944,000	48.75	1,006	1,022
3-28-78	0	2	1,426,000	24.0	990	990

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
3-29-78	0	2	1,403,000	24.4	958	974
3-30-78	0	2	1,332,000	23.7	937	925
4-1-78	0	2	1,140	21.8	872	792
4-2-78	0					
4-3-78	0		2,570,000	49.75	861	892
4-4-78	0	2	1,304,000	24.0	906	906
4-5-78	0	2	1,289,000	24.5	877	895
4-6-78	0	2	1,370,000	24.0	951	951
4-7-78	0	2	1,183,000	23.5	839	822
4-8-78	0					
4-9-78	0					
4-10-78	0	2	3,040,000	72.25	701	704
4-11-78	.23	2	1,613,000			
4-12-78	.56	2	2,964,000	23.2	2,129	2,058
4-13-78	.12	2	1,647,000	24.2	1,134	1,144
4-14-78	0	2	1,323,000	23.8	926	919
4-15-78	0	2	1,097,000	23.4	781	762
4-16-78	0					
4-17-78	0					

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
4-18-78	0.52	2	3,860,000	72.7	885	894
4-19-78	0	2	1,360,000	23.7	956	944
4-20-78	0	2	1,234,000	24.0	857	857
4-21-78	0	2	1,261,000	23.9	879	876
4-22-78	0	2	1,086,000	21.15	858	754
4-23-78	0					
4-24-78	0.41	2	2,610,000	51.03	852	906
4-25-78	0.49					
4-26-78	0.14					
4-27-78	0	2	4,628,000	72.1	1,060	1,071
4-28-78	0	2	1,382,000	24.0	960	960
4-29-78	0	2	1,209,000	22.0	916	840
4-30-78	0.83					
5-1-78	0.53					
5-2-78	0	2	4,933,000	74.0	1,111	1,142
5-3-78	0.34	2	1,837,000	24.3	1,260	1,276
5-4-78	0.35	2	1,680,000	22.0	1,273	1,167
5-5-78	0	3, 6" Pumps 1, 10" Pumps	2,845,500	25.7	1,845	1,976
5-6-78						
5-7-78	0.16					

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
5-8-78	1.0+	3-6"	3,099,000	71.2	725	717
5-9-78	0.02	3-6"	1,879,500	24.8	1,263	1,305
5-10-78	0.0	3-6"	2,364,000	24.13	1,633	1,642
5-11-78	0.0	3-6"	1,594,000	24.0	1,107	1,107
5-12-78	0.0	3-6"	1,558,000	23.62	1,099	1,032
5-13-78	0.49					
5-14-78	0.0	3-6"				
5-15-78	0.0	3-6"&10"				
5-16-78	0.0	3-6"	5,766,000	96.58	995	1,001
5-17-78	0.0	2-6"	1,226,000	23.35	875	851
5-18-78	0.28	2-6" 10"for 2Sh	2,257,000	23.67	1,589	1,567
5-19-78	0.0					
5-20-78	0.0	2-6"	2,836,000	47.5	995	985
5-21-78	0.0					
5-22-78	0.0	2-6"	2,884,000	49.43	972	1,001
5-23-78	0.0	2-6"	1,374,000	24.13	949	954
5-24-78	0.03	2-6"	1,604,000	24.23	1,103	1,114
5-25-78	0.0	2-6"	1,504,000	24.12	1,039	1,044
5-26-78	0.01	2-6"	1,451,000	22.92	1,055	1,008
5-27-78	0.00	2-6"	1,352,000	22.67	994	939

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
5-28-78						
5-29-78						
5-30-78	0.0	2-6"	5,044,000	73.27	1,147	1,168
5-31-78	0.0	2-6" 10" INT.	1,440,000	24.4	984	1,000
6-1-78	0.0	10"	1,560,000	24.17	1,076	1,083
6-2-78	0.0	2-6"	1,551,000	23.92	1,081	1,077
6-3-78	0.0	2-6"	1,188,000	21.67	914	825
6-4-78	0.0					
6-5-78	0.0	2-6"	2,944,000	50.75	967	1,022
6-6-78	0.92	2-6"	1,259,000	23.5	893	874
6-7-78	0.66	2-6"	1,475,000	22.33	1,101	1,021
6-8-78	1.61	2-6" 1-10" 4 Hr	3,138,000	25.7	2,035	2,170
6-9-78	0.0	2-6" 1-10"	3,828,000	23.17	2,754	2,658
6-10-78	0.0			overlap of data		
6-11-78	0.0					
6-12-78	0.03	2-6"	6,552,000	95.8	1,140	1,138
6-13-78	0.0	2-6"	1,391,000	24.12	961	966
6-14-78	0.0	2-6"	1,555,000	24.22	1,070	1,080
6-15-78	0.0	2-6"	1,361,000	23.65	959	945
6-16-78	0.0	2-6"	1,464,000	24.27	1,005	1,017

APPENDIX B (CONTINUED)

RBR DAILY PUMPING RECORD

DATE	PRECIP. (IN.)	NO. PUMPS	TOTAL PUMPING (GAL.)	HOURS PUMPED	HOURLY GPM	DAILY GPM (24 HRS.)
6-17-78	0.0	2-6"				
6-18-78	0.0					
6-19-78	0.0	2-6"	4,083,000	70.58	964	945
6-20-78	0.0	2-6"	1,389,000	25.67	902	965
6-21-78	0.0					
6-22-78	0.0	2-6"	2,652,000	47.12	938	921
6-23-78	0.0	2-6"	1,337,000	24.37	914	923

APPENDIX C

CONCRETE DAM DRILLING AND GROUTING SUMMARY

APPENDIX C

CONCRETE DAM
DRILLING AND GROUTING

SUMMARY

1. Feet Drilled 32636 ft.
2. Grout Volume 1209.7 cubic ft.
3. Volume Per Linear Foot 0.04 c.f./ft.
4. High Takes 635.90 cubic ft.

APPENDIX C (CONTINUED)
DRILLING AND GROUTING SUMMATION

Right Abutment Station 00+00, 03+36

	<u>FOOTAGE DRILLED</u>	<u>GROUT PLACED</u>	<u>GROUT DISTRIBUTION</u>
<u>Line A, Zone I</u>			
<u>0-41 Feet</u>			
Primary	656 (199.85)	63.1 (1.79)	.0962 (.0089)
Secondary	656 (199.95)	8.6 (.24)	.0131 (.0012)
Tertiary	1230 (374.90)	9.5 (.27)	.0077 (.0007)
Quaternary	369 (112.47)	24.1 (.68)	.0653 (.0060)
 <u>Line A, Zone II</u>			
<u>41-82 Feet</u>			
Primary	656 (199.95)	31.9 (2.32)	.1248 (.0116)
Secondary	656 (199.95)	13.9 (.39)	.0212 (.0020)
Tertiary	369 (112.47)	19.9 (.56)	.0539 (.0050)
Quaternary	246 (74.98)	1.4 (.04)	.0057 (.0005)
 <u>Line A, Zone III</u>			
Primary	656 (199.95)	85.6 (2.42)	.1305 (.0121)
Secondary	369 (112.47)	28.6 (.81)	.0775 (.0072)
Tertiary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Quaternary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

* Parenthesis represent metric conversions.

APPENDIX C (CONTINUED)
DRILLING AND GROUTING SUMMATION

Intake Section Station 03+36, 09+35.5

	<u>FOOTAGE DRILLED</u>	<u>GROUT PLACED</u>	<u>GROUT DISTRIBUTION</u>
<u>Line A, Zone I</u>			
<u>0-41 Feet</u>			
Primary	1230 (374.90)	163.4 (4.63)	.1328 (.0123)
Secondary	1230 (374.90)	34.4 (4.98)	.0282 (.0026)
Tertiary	2460 (749.81)	19.5 (.55)	.0079 (.0007)
Quaternary	369 (112.47)	11.2 (.32)	.0303 (.0028)
 <u>Line A, Zone II</u>			
<u>41-82 Feet</u>			
Primary	1230 (374.90)	18.0 (.51)	.0146 (.0014)
Secondary	1230 (374.90)	10.8 (.31)	.0088 (.0008)
Tertiary	246 (74.98)	2.6 (.07)	.0106 (.0010)
Quaternary	164 (50.00)	1.9 (.05)	.0116 (.0011)
 <u>Line A, Zone III</u>			
Primary	1230 (374.90)	7.6 (.21)	.0062 (.0006)
Secondary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Tertiary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Quaternary	82 (24.99)	0.4 (.01)	.0049 (.0004)

APPENDIX C (CONTINUED)
DRILLING AND GROUTING SUMMATION

Spillway Section Station 09+35.5, 15+95.5

	<u>FOOTAGE DRILLED</u>	<u>GROUT PLACED</u>	<u>GROUT DISTRIBUTION</u>
Line A, Zone I			
<u>0-41 Feet</u>			
Primary	1435 (437.39)	177.80 (5.03)	.1239 (.0115)
Secondary	1394 (424.89)	36.3 (1.03)	.0260 (.0024)
Tertiary	2829 (862.28)	72.1 (2.04)	.0255 (.0024)
Quaternary	779 (237.44)	46.3 (1.31)	.0594 (.0055)
Line A, Zone II			
<u>41-82 Feet</u>			
Primary	1435 (437.39)	53.8 (1.52)	.0375 (.0035)
Secondary	1394 (424.89)	12.6 (.36)	.0090 (.0008)
Tertiary	328 (99.97)	1.6 (.04)	.0049 (.0004)
Quaternary	41 (12.50)	0.1 (.003)	.0024 (.0002)
Line A, Zone III			
<u>82-123 Feet</u>			
Primary	1435 (437.39)	36.7 (1.04)	.0256 (.0024)
Secondary	1394 (424.89)	12.6 (.36)	.0090 (.0008)
Tertiary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Quaternary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

APPENDIX C (CONTINUED)
DRILLING AND GROUTING SUMMATION

Left Abutment Station 15+95.5, 18+83.5

	<u>FOOTAGE DRILLED</u>	<u>GROUT PLACED</u>	<u>GROUT DISTRIBUTION</u>
Line A, Zone I			
<u>0-41 Feet</u>			
Primary	574 (174.95)	84.3 (2.39)	.1469 (.0137)
Secondary	615 (187.45)	24.7 (.70)	.0402 (.0037)
Tertiary	1271 (387.40)	16.0 (.45)	.0126 (.0012)
Quaternary	451 (137.46)	7.1 (.20)	.0157 (.0015)
Line A, Zone II			
<u>41-82 Feet</u>			
Primary	574 (174.95)	3.3 (.09)	.0057 (.0005)
Secondary	615 (187.45)	9.1 (.26)	.0148 (.0014)
Tertiary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Quaternary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Line A, Zone III			
<u>82-123 Feet</u>			
Primary	574 (174.95)	8.2 (.23)	.0143 (.0013)
Secondary	164 (50.0)	0.4 (.01)	.0024 (.0002)
Tertiary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Quaternary	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

APPENDIX C (CONTINUED)

HIGH TAKES

<u>STATION</u>	<u>GROUT VOLUME C.F.</u>	<u>TYPE HOLE</u>	<u>ZONE</u>
00+56	13.9	T	2
00+61	14.2	S	3
00+81	58.1	P	3
01+20	17.5	P	1
01+20	60.3	P	2
02+18	12.8	Q	1
02+20	12.0	P	1
03+39	88.5	P	1
03+48	24.7	S	1
09+20	49.0	P	1
09+45	34.8	T	1
09+59	44.3	P	1
09+59D	18.9	P	1
10+17	22.6	P	2
10+97	24.9	P	1
11+17	30.0	P	1
12+02	11.0	T	1
15+71	11.5	P	1
15+81	20.3	S	1
16+93	55.9	P	1
17+33	10.7	P	1

APPENDIX C (CONTINUED)

NUMBER OF GROUT HOLES ACCEPTING 4 DIFFERENT RANGES OF GROUT VOLUME

	<u>0-3 c.f.</u>	<u>3-5 c.f.</u>	<u>5-8 c.f.</u>	<u>>8 c.f.</u>	<u>Total Grout (c.f.)</u>
	<u>Number of Holes</u>	<u>Number of Holes</u>	<u>Number of Holes</u>	<u>Number of Holes</u>	
<u>PRA (Primary Right Abutment)</u>					
1	10	1	2	3	63.1
2	14	1	1	1	81.9
3	12	1	1	2	85.6
<u>PI (Primary Intake)</u>					
1	25	1	2	2	163.4
2	27	2	1	0	18.0
3	30	0	0	0	-
<u>PSW (Primary Spillway)</u>					
1	25	1	3	6	17.1
2	31	2	1	1	5.0
3	32	1	1	1	36.1
<u>PLA (Primary Left Abutment)</u>					
1	9	1	2	2	24.3
2	14	0	0	0	1.1
3	14	0	0	0	8.1

APPENDIX C (CONTINUED)

NUMBER OF GROUT HOLES ACCEPTING 4 DIFFERENT RANGES OF GROUT VOLUME

	<u>0-3 c.f.</u>	<u>3-5 c.f.</u>	<u>5-8 c.f.</u>	<u>>8 c.f.</u>	Total Grout (c.f.)
	<u>Number of Holes</u>	<u>Number of Holes</u>	<u>Number of Holes</u>	<u>Number of Holes</u>	
<u>SRA (Secondary Right Abutment)</u>					
1	16	0	0	0	3.6
2	15	1	0	0	13.9
3	6	0	2	1	28.6
<u>SI (Secondary Intake)</u>					
1	30	0	0	1	34.7
2	30	0	0	0	10.3
3	0	0	0	0	0
<u>SSW (Secondary Spillway)</u>					
1	31	0	2	3	11
2	33	1	0	0	11
3	2	0	0	0	0
<u>SLA (Secondary Left Abutment)</u>					
1	12	1	1	1	24.7
2	14	0	1	0	11
3	4	0	0	0	11

APPENDIX C (CONTINUED)

NUMBER OF GROUT HOLES ACCEPTING 4 DIFFERENT RANGES OF GROUT VOLUME

	<u>0-3 c.f.</u>	<u>3-5 c.f.</u>	<u>5-8 c.f.</u>	<u>>8 c.f.</u>	Total Grout (c.f.)
	<u>Number of Holes</u>	<u>Number of Holes</u>	<u>Number of Holes</u>	<u>Number of Holes</u>	
<u>TRA (Tertiary Right Abutment)</u>					
1	30	0	0	0	1.5
2	8	0	0	1	10.0
3	0	0	0	0	0.0
<u>TI (Tertiary Intake)</u>					
1	59	0	0	0	10.5
2	6	0	0	0	2.0
3	0	0	0	0	0.0
<u>TSW (Tertiary Spillway)</u>					
1	30	1	0	0	1.5
2	0	0	0	0	0.0
3	0	0	0	0	0.0

APPENDIX C (CONTINUED)

NUMBER OF GROUT HOLES ACCEPTING 4 DIFFERENT RANGES OF GROUT VOLUME

	<u>0-3 c.f.</u>	<u>3-5 c.f.</u>	<u>5-8 c.f.</u>	<u>>8 c.f.</u>	<u>Total</u> <u>Grout</u> <u>(c.f.)</u>
	<u>Number of</u> <u>Holes</u>	<u>Number of</u> <u>Holes</u>	<u>Number of</u> <u>Holes</u>	<u>Number</u> <u>of Holes</u>	
<u>QRA (Quaternary Right Abutment)</u>					
1	7	0	0	2	24.1
2	6	0	0	0	1.4
3	0	0	0	0	0.0
<u>QI (Quaternary Intake)</u>					
1	7	2	0	0	11.2
2	4	0	0	0	1.0
3	2	0	0	0	0.0
<u>QSW (Quaternary Spillway)</u>					
1	18	0	0	1	2.0
2	1	0	0	0	0.0
3	0	0	0	0	0.0
<u>QLA (Quaternary Left Abutment)</u>					
1	10	1	0	0	2.1
2	0	0	0	0	0.0
3	0	0	0	0	0.0

APPENDIX C (CONTINUED)

EXCESSIVE GROUT TAKES

<u>HOLE NO.</u>	<u>STAGE *</u>	<u>TAKE</u>	<u>REMARKS</u>
0+06	1	7.1	Fan hole, communicated with 0+10.
0+10	1	14.6	Fan hole, communicated with outside of dam.
0+14	1	7.9	Fan hole, grout leaked from pores in gutter and gallery floor.
0+41	3	5.6	Primary, communicated with tertiary hole already grouted.
0+56	3	13.9	Tertiary.
0+61	3	14.2	Primary, communicated with secondary hole already grouted.
0+81	3	58.1	Primary, communicated with 5 holes, one 100 feet away.
0+86	1	8.3	Tertiary, communicated with adjacent holes.
1+00	1	9.0	Primary, communicated with a drain and M 2/3 joint.
1+20	1	17.5	Primary.
	2	59.4	Primary, communicated with 5 holes, one 60 feet away.
	3	5.4	Secondary.
1+30	3	54.0	Secondary.
1+40	1	6.2	Primary, communicated with adjacent primary.
	2	5.8	Primary.
	3	6.2	Primary.
2+00	3	8.6	Primary, communicated with adjacent primary, pushed water 60 feet away.
2+18	1	12.8	Quaternary, communicated with M 4/5 joint.
2+20	1	12.0	Primary, communicated with next 3 primaries (60 feet).
3+39	1	88.5	Primary, communicated as described in text, page 67, paragraph 3.
3+46	1	22.9	Secondary, communicated with one other hole.
3+82	1	6.2	Primary, communicated with adjacent primary.
6+01	1	6.9	Primary, communicated with drain.
	2	6.0	Primary, communicated with previously grouted tertiary 51 feet away.
9+20	1 EX	49.0	Primary, communicated with 9+40.

APPENDIX C (CONTINUED)

<u>HOLE NO.</u>	<u>STAGE *</u>	<u>TAKE</u>	<u>REMARKS</u>
9+45	1 SUR	34.6	Tertiary, communicated with 3 other holes (2 previously grouted) and a drain.
9+59	1 EX	44.2	Primary.
9+62	1 EX	7.9	Secondary, communicated with 2 other holes.
9+65	1 SUR	18.3	Primary, communicated with 2 other holes and a drain.
9+69	1 EX	6.03	Secondary, communicated with 2 other holes and a drain.
9+77	1 EX	7.4	Primary.
	2	6.45	Primary.
9+97	3	5.36	Primary, communicated with 10+01.
10+17	1 EX	5.1	Primary.
	2	22.6	Primary, communicated with 3 other holes, one 80 feet away.
10+97	1 EX	24.9	Primary, communicated with 2 other holes, one 40 feet away
11+17	1 EX	30.0	Primary, communicated with 11+41.
11+20	1 EX	39.0	Quaternary.
12+02	2 SUR	12.71	Tertiary, showed artesian flow prior to grouting, communicated with next tertiary hole.
15+71	1 SUR	11.29	Primary, intersected IPB pipe.
15+81	1 SUR	20.3	Secondary, communicated with 6 other holes, one 50 feet away.
16+07	1 SUR	6.86	Primary, communicated with next primary hole.
16+93	1 EX	55.35	Primary, communicated as described in text, page 66, paragraph 3.
17+03	1 EX	6.36	Secondary.
17+33	1 SUR	10.7	Primary.

* 1 EX indicates grout placed through pneumatic packer.

1 SUR indicates grout placed through mechanical packer after refusal with pneumatic packer.

1, 2, or 3 without additional notation indicates that the entire zone was grouted in one step through a mechanical packer.

APPENDIX D

EARTH EMBANKMENTS - STEEL FIBROUS SHOTCRETE
CORE SAMPLES

APPENDIX D

EARTH EMBANKMENTS

STEEL FIBROUS SHOTCRETE CORE SAMPLES

<u>CORE NO.</u>	<u>DATE</u>	<u>STATION</u>	<u>OFFSET</u>	<u>THICKNESS (IN.)</u>	<u>REMARKS</u>
1	10/21/80	7+90	U/S Wall	7½	
2	10/21/80	7+80	U/S Wall	4½	
3	10/21/80	7+50	D/S Wall	7	
4	10/17/80	7+25	D/S Wall	4½	
5	10/16/80	7+80	D/S Wall	7	
6	12/12/80	6+85	6' U/S	3½	
7	12/3/80	8+12	18' D/S	4½	
8	12/11/80	9+04	U/S Wall	9	
8A	12/11/80	9+05	U/S Wall	3½	
8B	12/11/80	9+06	U/S Wall	6	
9	12/29/80	6+87	14' U/S	4	
10	12/31/81	7+07	33' U/S	4	
11	1/2/81	6+79	Centerline	4½	
12	1/7/81	7+50	12' D/S	3½	
13	1/8/81	7+22	8' D/S	3½	
14	1/9/81	7+60	Centerline	5	
15	1/13/81	7+25	10' U/S	5	
16	1/19/81	22+00	35' D/S	3½	
17	1/20/81	22+30	63' D/S	3½	
18	1/15/81	7+45	24' U/S	3½	
19	1/16/81	8+43	36' U/S	3½	
20	1/22/81	23+30	86' D/S	6½	
21	1/23/81	22+92	86' D/S	3½	
22	1/26/81	23+35	46' D/S	3	
23	1/27/81	23+30	22' D/S	4½	
24A	1/23/81	22+00	70' D/S	3½	
24B	1/23/81	22+00	72' D/S	3½	
25	1/28/81	22+90	23' D/S	3	
26	1/29/81	22+85	10' U/S	3-3/4	
27	2/2/81	23+25	Centerline	4½	
28	2/9/81	22+60	6' U/S	4½	
29	2/10/81	22+50	10' D/S	2	Area Reshot
30	2/5/81	24+46	-----	4½	
31	2/6/81	24+28	-----	3½	
32	2/11/81	22+50	Centerline	5	
33	2/12/81	22+00	12' D/S	4½	
34	2/13/81	21+85	19' U/S	5	
35	2/16/81	22+00	25' U/S	3½	
36	2/17/81	22+20	30' U/S	3½	
37	2/20/81	22+95	13' U/S	7	
38	2/23/81	22+70	18' U/S	4½	
39	2/24/81	22+00	70' D/S	6½	
40	2/25/81	23+75	Bottom D/S Niche	3	

APPENDIX D (CONTINUED)

<u>CORE NO.</u>	<u>DATE</u>	<u>STATION</u>	<u>OFFSET</u>	<u>THICKNESS (IN.)</u>	<u>REMARKS</u>
41	2/26/81	23+25	-----	3½	
42	2/27/81	21+80	15' D/S	3	
42A	2/27/81	21+80	15' D/S	6	
43	3/2/81	21+70	38' D/S	10½	
44	3/3/81	21+60	14' D/S	4	
45	3/4/81	21+40	18' D/S	3½	
46	3/5/81	21+05	16' D/S	3½	
47	3/6/81	-----	17' U/S	3½	
48	3/9/81	23+78	D/S Niche	11+	
49A	3/10/81	24+02	D/S Niche	10+	
49B	3/11/81	24+62	D/S Niche	11+	
49C	3/11/81	24+46	D/S Niche	11½+	
50	3/11/81	21+00	40' D/S	5	
51	3/12/81	20+83	24' D/S	4½	
52	3/13/81	20+60	8' U/S	3½	
53	-----	-----	-----	-----	Not Taken
54	-----	-----	-----	-----	Not Taken
55	-----	-----	-----	-----	Not Taken
56	-----	-----	-----	-----	Not Taken
57	-----	-----	-----	-----	Not Taken
58	5/27/82	11+25	6' D/S	3½	
59	5/28/82	10+85	15' D/S	3"	
60	6/3/82	10+80	12' D/S	4½	
61	6/4/82	10+70	27' D/S	5½	
62	6/9/82	10+47	6' D/S	5½	
63	6/10/82	10+38	30' D/S	3	
64	6/14/82	9+74	25' D/S	5½	
65	6/15/82	9+75	24' U/S	4	
66	7/1/82	11+58	2' D/S	3½	
67	6/30/82	11+85	3' D/S	4	
68	6/29/82	11+30	40' U/S	4	
69	6/25/82	11+50	40' U/S	4	
70	8/12/82	17+08	95' U/S	3	
71	8/13/82	16+98	95' U/S	3	
72	8/16/82	17+25	75' U/S	5½	
73	8/17/82	17+25	70' U/S	5	
74	8/18/82	17+00	65' U/S	3½	
75	8/19/82	16+88	75' U/S	4	
76	8/20/82	16+30	105' U/S	4½	
77	8/21/82	16+40	95' U/S	3	
78	8/23/82	16+24	80' U/S	3½	
79	8/24/82	16+28	75' U/S	3½	
80	8/25/82	16+28	60' U/S	3	
81	8/26/82	16+58	85' U/S	4½	
82	8/28/82	16+25	105' U/S	3	

APPENDIX D (CONTINUED)

<u>CORE NO.</u>	<u>DATE</u>	<u>STATION</u>	<u>OFFSET</u>	<u>THICKNESS (IN.)</u>	<u>REMARKS</u>
83	8/30/82	15+10	30' U/S	4	
84	8/31/82	15+50	35' D/S	3	
85	9/1/82	15+00	5' D/S	3½	
86	9/2/82	15+00	50' D/S	3	
87	9/3/82	14+30	8' D/S	3½	
88	9/7/82	14+38	25' D/S	3½	
89	9/9/82	15+70	70' U/S	3	
90	9/10/82	15+70	40' U/S	5	
91	9/11/82	17+50	50' U/S	3½	
93	9/14/82	17+65	20' U/S	4½	
94	9/15/82	17+65	30' D/S	3½	
95	9/16/82	17+90	2' U/S	3½	
96	9/17/82	17+80	30' D/S	5	
97	9/18/82	17+25	Centerline	3½	
98	9/20/82	19+25	20' D/S	3	
99	9/21/82	19+40	4' U/S	5½	
100	9/22/82	19+07	20' U/S	3½	
101	9/23/82	18+38	10' D/S	3½	
102	8/24/82	17+70	50' U/S	----	Not Recorded
103	9/24/82	17+25	170' U/S	4½	
104	9/25/82	17+25	90' U/S	3½	
105	9/27/82	16+25	35' U/S	3½	
106	9/28/82	17+00	35' U/S	3	
107	9/29/82	15+37	5' D/S	3	
108	9/30/82	15+65	22' D/S	4	
109	10/1/82	17+21	18' D/S	4	
110	10/2/82	17+18	9' U/S	5	
111	10/4/82	16+81	40' D/S	3	
112	10/5/82	15+76	45' D/S	4½	
113	10/6/82	16+00	50' D/S	3½	
114	10/7/82	16+25	45' D/S	4	
115	10/15/82	13+90	35' D/S	4½	
116	10/18/82	14+00	20' U/S	4½	

APPENDIX E

UNCONFINED COMPRESSION TESTING OF STEEL FIBROUS
SHOTCRETE CORE SAMPLES

APPENDIX E

UNCONFINED COMPRESSION TESTING
OF STEEL FIBROUS SHOTCRETE CORE SAMPLES

CORE NO.	COMPRESSIVE STRENGTH (PSI) AT AGE (DAYS)					
	<u>7</u>	<u>14</u>	<u>28</u>	<u>56</u>	<u>1 Year</u>	<u>3 Year</u>
1				6820		
3				6570		
4						7330
5						5480
6	2340					
8	2470					
8B			2950			
9		6170				
10		5560				
12						6555
14		5400				
15	3090					
16		4834				
19			2905			
21	5043					
23	5159					
25		4489				
26	5508					
27	4133					
30			6028			
32		5015				
36	4440					
103					7240	
104					4865	
116					3980	

APPENDIX F

EARTH EMBANKMENTS - SHOTCRETE BEAM FLEXURE
TEST RESULTS

APPENDIX F

EARTH EMBANKMENTS
SHOTCRETE BEAM FLEXURE TEST RESULTS

FLEXURE STRENGTH (PSI) AT AGE (DAYS)

BEAM	7	14	28	90	Other
3					747 (98)
4					864 (97)
5					1029 (44)
9				630	
10				1114	
13					895 (31)
17				1036	
19				740	
20				803	
21				849	
22				639	
23			975		
24			910		
25		1025			
26		1090			
27		1000			
28			707		
29	900				
30	778				
31	799				
32	968				
33	860				
34		670			
35	570				
36	810				
37	700				
38			518		
39		1030			
40		815			
41			793		
42		567			
43	686				
44	820				
45	713				
46		664			
47	687 (8)				
48	928				
49					404 (1 day)
50			851		
53		1023			
57	734				
63			775		
70		730			
122					878 (381 days)
123					585 (379 days)
126					910 (376 days)

APPENDIX G

VARIATIONS IN ESTIMATED QUANTITIES
(EARTH EMBANKMENTS)

APPENDIX C
VARIATIONS IN ESTIMATED QUANTITIES (EARTH EMBANKMENTS)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
2	8" Stabilized Aggregate Base Course	3,009 SY	3,533 SY	117	Original estimated quantity was low
3	4" Stabilized Aggregate Base Course	5,500 SY	5,289 SY	96	
4	18" Culvert	42 LF	42 LF	100	
5	24" Culvert	62 LF	68 LF	110	
6	Concrete Headwall	2.1 CF	2.1 CF	100	
7	Concrete Ditch Pavement	75 CY	80 CY	107	
9	Excavate Second Stage Cofferdike	101,917 CY	104,120 CY	102	
11b	Dewater System One Maintain and Operate	6 months	23.16 months	368	Dewatering system taken over from concrete dam, at same cost per month; same contractor.
12	Dewater System Two	18 months	0	0	Did not utilize system.
13b	Dewater System Three Maintain and Operate	18 months	8 months	44	Did not need system any longer.
15	Temporary Silt Fences	3,100 LF	2,173 LF	70	Entire quantity not needed for silt control.

APPENDIX C (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
16	Silt Basins	8 EA	6 EA	75	Entire quantity not needed for silt control.
17	Exploratory Core Borings	2,300 LF	2,300 LF	100	
18	Portland Cement in Grout	100 CF	60 CF	60	See Note 1.
19	Place Grout	400 CF	96.5 CF	24	See Note 1.
20a	Excavation-Common First 350,000 CY	350,000 CY	350,000 CY	100	
20b	Excavation-Common over 350,000 CY	54,100 CY	195,559 CY	361	Excessive unsatisfactory material in cutoff trench, terminal cone areas; removal of erosion gullies; excavation for oxygen system.
21	Excavation-Impervious Borrow	1,991,618 CY	2,243,922 CY	113	
22	Excavation-Sand Borrow	970,347 CY	936,746 CY	96	
23a	Excavation-Rock, 1st 50,000 CY	50,000 CY	47,522 CY	95	
23b	Excavation-Rock, over 50,000 CY	19,100 CY	0	0	Not needed.
24a	Excavation-Dental, 1st 100 CY	100 CY	100 CY	100	

APPENDIX G (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
24b	Excavation-Dental, over 100 CY	100 CY	4,461	4,461	Contract quantity adequate for grout cap excavation, not provided for required work to properly prepare foundation; 249 CY in 2nd stage dike.
25b	Drill Grout Hole	44,450 LF	97,575 LF	219	See Note 2.
25c	Steel Pipe and Fittings	53,304.25 LBS	70,867.08 LBS	133	See Note 2.
25d	Portland Cement in Grout	5,737 CF	13,257 CF	231	See Note 2.
25e	Bentonite in Grout	19,600 LBS	12,754 LBS	65	See Note 2.
25f	Pressure Wash and Test	402.34 HRS	973.14 HRS	242	See Note 2.
25g	Place Grout	17,074 CF	37,145.5 CF	217	See Note 2.
25h	Connect to Grout Hose	1,667 EA	3,224 EA	193	See Note 2.
26a	Foundation Cleanup-Rock Surfaces, 1st 7,500 SY	7,500 SY	7,500 SY	100	
26b	Foundation Cleanup of Rock Surfaces; over 7,500 SY	2,500 SY	24,184.3 SY	967	See Note 3.

APPENDIX C (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
Final Foundation Prep.					
27a	Rock Surf. 1st 12,497 SY	12,497 SY	12,497 SY	100	
Final Foundation Preparation of Rock Surfaces over 12,497 SY					
27b		2,000 SY	26,479.5 SY	1,324	See Note 3.
Concrete Treatment					
28a	1st 100 CY	100 CY	100 CY	100	
Concrete Treatment over 100 CY					
28b		200 CY	2,622.3 CY	1,311	Contract quantity adequate for grout cap; none provided for fillets, dental concrete, etc. used 1199 CY on 2nd stage cofferdike foundation.
Cork/Bituminous Expansion Joint					
29		JOB	NONE	0	Not utilized, SAS, SAD, OCE.
Portland Cement in Shotcrete					
30b		18,000 CF	21,037 CF	117	See Note 4.
Steel Fibers in Shotcrete					
30c		210,000 LBS	421,340 LBS	201	See Note 4.
Place Shotcrete					
30d		40,000 CF	67,173 CF	168	See Note 4.
Impervious Compacted					
31		1,491,168 CY	1,686,776 CF	113	
IWR Compacted					
32		374,700 CY	378,129 CY	101	
Sand Compacted					
33		605,550 CY	628,390 CY	104	

APPENDIX C (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
34	Sand Filter Compacted	166,447 CY	162,741 CY	98	
35	Coarse Filter Compacted	132,682 CY	123,425 CY	93	
36	Minus 3" Firm Rock Compacted	32,560 CY	26,715 CY	82	
37	3 x 20 Firm Rock Compacted	173,600 CY	169,204 CY	97	
38	3 x 20 Sound Rock Compacted	308,958 CY	310,775 CY	101	
39	Drain Rock	30,100 CY	35,646.8 CY	118	Diversion channel foundation very irregular, filled lower area w/drain rock before beginning 7' measured, effective thickness.
40	IWR Traffic Compacted	39,000 CY	37,713 CY	97	
41	-3" Firm Rock Traffic Compacted	24,600 CY	34,554.9 CY	141	Associated with Mod. M. Possible error in estimate.
42	IWR-Traffic Compacted 2nd Stage Cofferdike	174,431 CY	176,719 CY	101	
43a	Additional Rolling for Compaction-1st 50 hrs.	50 HRS	50 HRS	100	
43b	Additional Rolling for Compaction, over 50 hrs.	250 HRS	26.5 HRS	10.6	Total Amount
46	Coarse Filter, Stockpiled	7,500 CY	7,500 CY	100	

APPENDIX C (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
47	Riprap, Stockpiled	15,000 CY	50,000 CY	337	Includes powerhouse riprap, excess 3 x 20 sound rock. Stockpiles required to be purchased under Mod. I - P004.
50	3" Coarse Aggregate Stockpiled	45,000 CY	45,346.5 CY	101	
51a	Rock Fill Gradation Tests - 1st 12	12 EA	12 EA	100	
51b	Rock Fill Gradation Tests, over 12	6 EA	3 EA	50	Total quantity not needed.
52a	Riprap Gradation Tests - 1st 5	5 EA	5 EA	100	
52b	Riprap Gradation Tests - over 5	3 EA	11 EA	367	Additional tests needed for control.
53	Coarse Filter-Uncompacted	10,700 CY	10,447 CY	98	
54	Sand Filter Uncompacted	6,800 CY	6,345 CY	93	
55	Riprap	39,000 CY	37,340.3 CY	96	
56	Dumped Firm Rock, Unprocessed	17,298 CY	18,405 CY	106	
58	Guardrail	5,125 LF	5,161 LF	101	
59	Anchors	8 EA	8 EA	100	

APPENDIX C (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
62a	4" Center Striping	715 LF	0	0	Not required for contract.
62b	4" Edge Striping	7,475 LF	7,062.3 LF	95	
63	Clearing and Grubbing	116 ACRES	135 ACRES	116	Additional clearing required due to impervious borrow expansion.
64	2" Bituminous Surfacing	5,817 SY	5,784 SY	99	
65	Seeding Grasses	108 ACRES	139.7 ACRES	129	Additional acres in borrow area and rock stockpiles.
66	Mulching	108 ACRES	139.7 ACRES	129	Additional acres in borrow area and rock stockpiles.
67	Tree Seedlings	90 ACRES	90 ACRES	100	
68	Concrete Right of Way Markers	20	20	100	
69	Unclassified Excavation for Roads	15,000 CY	29,912 CY	199	Unanticipated excavation to remove erosion gullies at end of transition trenches, i.e., beneath service roads.
70	IRV Fill for Roads	1,000 CY	1,905.4 CY	190	More fill than originally anticipated.
71a	Placing Mortar 1st 50 CY	50 CY	49 CY	98	
71b	Placing Mortar over 50 CY	0	0	0	Not needed.

APPENDIX G (CONTINUED)

ITEM NO.	DESCRIPTION	FINAL EST. QUANTITY	FINAL QUANTITY	PERCENTAGE OF EST. QUANTITY	REMARKS
72	Unclassified Excavation Fill and Roads	10,500 CY	16,609.5 CY	158	Fill required to refill excavation for erosion of gullies.

NOTE 1: Many of the exploratory borings were grouted under Item No. 25d and 25g which had lower unit price and was more convenient for both Government and Contractor.

NOTE 2: Government estimate entirely too low. Inadequate test data on which to base estimate.

NOTE 3: Quantities entirely too low for work required. Neat-line bottom width would have exceeded estimated quantities, plus slope area; 2/3 of estimated FFP quantity in diversion channel. Cleanup less than FFP quantity; however, cleanup could be performed more than once. Cleanup was 23% over FFP.

NOTE 4: Estimated quantities not sufficient. Estimated quantity probably assumed 3-inch application. No maximum specified in contract. Many areas up to 4-5 inches in thickness to minimum irregularities in rock surfaces.

APPENDIX H

POWERHOUSE "NOSE" GROUTING DATA

APPENDIX H

NOSE No. 041		POWERHOUSE "NOSE" GROUTING DATA								
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE LENGTH (FEET)	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:
O-V	1	7/28/82	7/30/82	30	8.3	15.4	21	5:1 3:1 1:1	7.5 21 11.5	
O-V 182	1	7/31/82	8/2/82	30	TIGHT		2			JUST TREATED GROUTED WITH 1:1
O-W	1	7/28/82	7/30/82	30	4.5	.45		5:1	2.5	MULTI SURFACE LEAKS
O-X	1	7/27/82	7/30/82	30	11.6	2.93	8	5:1 1:1	7.0 2.5	Communicated with O-Y & S/L
O-Y	1	7/27/82	7/30/82	30	7.8	1.33		1:1	2.0	
O-Z	1	7/28/82	7/30/82	30	.5	0		5:1	0	
1A-1	1	7/23/82	7/31/82	30	.03	0	2	5:1	0	
1A-2	1	7/24/82	7/31/82	30	2.0	.18	2	5:1	6.5	
1A-2.5	1	8/10/82	8/11/82	30	0	.18	2	5:1	11.0	
1A-3	1	7/23/82	7/31/82	30	18.0	3.27	2	5:1	18.0	Communicated with A-4, B-3, & E
1A-4	1	7/27/82	8/2/82	30	Comm @ A3	.18	5	5:1	11.0	
1A-5	1	7/27/82	8/2/82	30	Comm @ A3	0		5:1	0	
1A-6	1	7/27/82	8/2/82	30	Comm @ A3	0		5:1	0	
1A-7	1	7/27/82	8/2/82	30	Comm @ A3	.09		5:1	0.5	
1A-8	1	7/29/82	8/2/82	30	Comm @ A3	.36		5:1	2.0	Communicated with B-5 & SURFACE LEAKS
1A-9	1	7/29/82	8/2/82	30	2.5	.09		5:1	0.5	
1B-1	1	7/24/82	7/31/82	30	1.0	.63		5:1	3.5	
1B-1.5	1	8/9/82	8/11/82	30	0	0	1	5:1	0	

APPENDIX H (CONTINUED)

NOSE No. 1 & 2		POWERHOUSE "NOSE" GROUTING DATA								
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE LENGTH (FT)	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:
1B-2	1	7/23/82	7/31/82	30	Comm. A-3	2.81	2	5:1	15.5	Communicate with A-3 & A-6
1B-3	1	7/23/82	8/2/82	30	Comm. A-3	.90	4	5:1	5.0	
1B-4	1	7/23/82	8/2/82	30	Comm. A-3	.18		5:1	1.0	Communicate with A-6
1B-5	1	7/21/82	8/2/82	30	Comm. A-3	.09		5:1	0.5	
1B-6	1	7/21/82	8/2/82	30	Comm. C-1	1.09	1	5:1	5.0	
1C-1	1	7/24/82	8/2/82	30		4.0	1.45	2	5:1	3.0
1C-2	1	7/22/82	8/2/82	30	Comm. C-2	.09		5:1	0.5	
C-3	1	7/22/82	8/2/82	30	Comm. C-1	.09		5:1	0.5	
1C-4	1	7/2/82	8/2/82	30	Comm. C-2	.09		5:1	0.5	
2A-1	1	8/2/82	8/5/82	30		2.0	.57	4	3:1	2.0
2A-1.5	1	8/11/82	8/12/82	30		0.2	0	3:1	0	
2A-2	1	8/2/82	8/15/82	30		10.0	10.4	3:1 1:1	23.0 3.0	
2A-2.5	1	8/7/82	8/18/82	30		0.3	3.71	3:1 1:1	2.5 1.5	MULTI S/L
2A-3	1	8/4/82	8/15/82	30	Comm. C-1	0		3:1	0	
2A-3.5	1	8/15/82	8/19/82	30		2.0	.27	3	5:1	1.5
2A-4	1	8/14/82	8/15/82	30		0.0	5.3	3:1 1:1	12.0 2.5	Communicate with A-5
2A-4.5	1	8/17/82	8/19/82	30		1.0	.36		5:1	2.0
2A-5	1	8/14/82	8/15/82	30		10.5	2.66	4	1:1	4.0
2A-5.5	1	8/12/82	8/19/82	30		4.0	1.18		5:1	6.5
2A-6	1	8/13/82	8/15/82	30		1.3	2.0	3:1 1:1	6.5 2.5	MULTI SURFACE LAMS Re-drilled. SEE 2A-5 on next page

APPENDIX H (CONTINUED)

NOSE No. 2 & 3		POWERHOUSE "NOSE" GROUTING DATA								
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE LENGTH (FEET)	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:
* 2A-6	1	8/9/82		30	.2	.27	1	5:1	1.5	
2A-7	1	8/10/82	8/15/82	30	Comm. A-1	.71		3:1	2.5	
2B-1	1	8/13/82	8/15/82	30	Comm. A-1	.28		3:1	1.0	
2B-2	1	8/13/82	8/15/82	30	Comm. A-1	3.0	3	3:1	0.5	
2B-3	1	8/14/82	8/15/82	30	2.9	0		3:1	0	
2B-4	1	8/14/82	8/15/82	30		.23		3:1	1.0	
2B-5	1	8/15/82	8/15/82	30	4.4	.14		3:1	0.5	
2B-6	1	8/15/82	8/15/82	30	3.0	.28		3:1	1.0	
2C-1	1	8/15/82	8/15/82	30	Comm. A-1	0		3:1	0	
2C-2	1	8/15/82	8/15/82	30	7.5	0		3:1	0	
2C-3	1	8/15/82	8/15/82	30	5.0	.23		3:1	0	
2C-4	1	8/15/82	8/15/82	30	3.3	.14		3:1	0.5	
3A-1	1	8/21/82	9/7/82	30	2.23	.28		3:1	1.0	
3A-2	1	8/22/82	9/7/82	30	15.0	1.71		3:1	5.0	common hole with 3B-2
3A-3	1	8/22/82	9/7/82	30	Comm. B-3, 4	2.71	3	3:1	5.0	with surface leakage
3A-4	1	8/22/82	9/7/82	30	Comm. A-2, 3-4	.28	3	3:1	1.0	
3A-5	1	9/1/82	9/7/82	30	10.27	2.18	3	3:1	2.0	common hole with 3B-5, 6, 7
3A-6	1	9/1/82	9/8/82	30	16.0	0		3:1	0	
3B-1	1	8/31/82	9/8/82	30	Comm. A-1	2.14	3	3:1	1.5	
3B-2	1	8/30/82	9/8/82	30	Comm. A-1	1.14		3:1	4.0	

APPENDIX H (CONTINUED)

NOSE No. 3 & 4		POWERHOUSE "NOSE" GROUTING DATA								
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE LENGTH (ft)	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:
3B-3	1	9/2/82	9/8/82	30	12.53	.28	1	3:1	1.0	SURFACE LEAKAGE
3B-4	1	8/31/82	9/8/82	30	12.53	.57		3:1	2.0	
3B-5	1	9/1/82	9/8/82	30	Comm. A-5-2	3.75	6	3:1 1:1	8.5 2.0	MULTI SURFACE LEAKAGE
3B-6	1	2/30/82	9/8/82	30	MULTI S/L	.28		3:1	1.0	
3C-1	1	8/30/82	9/8/82	30	Comm. A-1	.57		3:1	2.0	
3C-2	1	8/30/82	9/8/82	30	Comm. A-2	.28		3:1	1.0	
3C-3	1	8/31/82	9/8/82	30	13.33	1.42		3:1	5.0	SURFACE LEAKS
3C-4	1	8/31/82	9/8/82	30	3.27	0		3:1	0	
4A-1	1	10/9/82	10/21/82	30	2.2	.42	3	3:1	1.5	
4A-2	1	10/9/82	10/21/82	30	11.6	1.22		3:1	4.5	
4A-3	1	10/11/82	10/21/82	30	6.4	7.35	2	3:1 1:1	21.0 2.5	
4A-4	1	10/16/82	10/21/82	30	12.1	1.71	8	3:1 1:1	13.0 24.0	MULTI SURFACE LEAKS - CAME OUT OF HOLE DURING GROUTING
4A-5		10/19/82	—	30	10.5					NOT GROUTED - HOLE TO BE GROUTED WITH 100% PORTLAND CEMENT
4A-6		10/12/82	10/22/82	30	13.33	.4		3:1	0.5	
4A-7		10/11/82	10/22/82	30	13.33	0		3:1	0	
4A-8	1	10/7/82	10/22/82	30	13.0	.33		1:1	0.5	
4A-9	1	10/9/82	10/22/82	30	6.0	1.66		1:1	2.5	
4A-10	1	10/11/82	10/22/82	30	.01	0		1:1	0	
4S-1	1	10/19/82	10/21/82	30	11.0	.71		3:1	0	
4B-2	1	10/12/82	10/21/82	30	13.3	.35		3:1	3.0	SURFACE LEAKS

APPENDIX H (CONTINUED)

NOSE No. 445		POWERHOUSE "NOSE" GROUTING DATA								
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE LENGTH (FT)	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:
4B-3	1	10/13/82	10/21/82	30	15.9	.25		3:1	3.0	SURFACE LEAKS
4B-4	1	10/16/82	10/22/82	30	10.13	.28	3	3:1	1.0	
4B-5	1	10/16/82	10/22/82	30	13.33	.28		3:1	1.0	
4B-6	1	10/15/82	10/22/82	30	12.8	1.4	2	3:1	4.0	
4B-7	1	10/13/82	10/22/82	30	13.05	5.27	18	3:1 1:1 2:1	25.5 11.5 1.5	COMMON GROUT WITH A-3 A-4 & 3-7
4B-8	1	10/17/82	10/22/82	30	6.1	.33		1:1	0.5	
4C-1	1	10/13/82	10/20/82	30	.01	0		3:1	0	
4C-2	1	10/19/82	10/22/82	30	17.6	3.14	3	3:1	11.0	SURFACE LEAKS
4C-3	1	10/19/82	10/22/82	30	10.25	1.4		3:1	0.5	
4C-4	1	10/16/82	10/22/82	30	14.0	.29		3:1	1.0	
4C-5	1	10/19/82	10/22/82	30	12.8	4.85	6	3:1	17.0	COMMON GROUT WITH A-3 A-4 & 3-7
4C-6	1	10/16/82	10/22/82	30	5.6	.27		3:1	1.0	
5A-1	1	11/20/82	12/16/82	30	5.2	7.4	9	3:1	25.0	
5A-2	1	11/27/82	12/16/82	30	10.0	15.46	16	3:1 1:1	48.5 2.5	SURFACE LEAKS
5A-3	1	11/29/82	12/16/82	30	9.73	15.94	17	3:1 1:1	14.5 23.5	SURFACE LEAKS
5A-4	1	11/30/82	12/17/82	30	Comm. A-7	0		3:1	0	
5A-5	1	11/30/82	12/17/82	30	Comm. A-7	.28		3:1	1.0	
5A-6	1	12/1/82	12/17/82	30	Comm. A-7	0		3:1	0	
5A-7	1	12/1/82	12/17/82	30	Comm. A-7	1.35	5	1:1	2.0	
5A-8	1	12/1/82	12/17/82	30	Comm. A-7	1.66		1:1	2.5	

APPENDIX H (CONTINUED)

NOSE No. 5 ± 6		POWERHOUSE "NOSE" GROUTING DATA								
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE LENGTH (ft)	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:
5A-9		12/7/82	12/17/82	30	Comm. with A-7	.66		1:1	1.0	
5A-10		12/7/82	12/17/82	30	Comm. A-7	.33		1:1	2.0	EXCESSIVE SURFACE LEAKS
5A-11		12/7/82	12/17/82	30	Comm. A-7 A-12	1.33	5	1:1	2.0	
5A-12		12/14/82	12/17/82	30	Comm. A-7, A-11	0		1:1	0	
5B-1		11/30/82	12/16/82	30	12.0	1.0	3	3:1	3.5	
5B-2		11/30/82	12/16/82	30	11.46	4.0		1:1	5.0	
5B-3		11/30/82	—	30	12.0					Plugged with grout from 5B/82
5B-4		12/6/82	—	30	10.66					Plugged with grout from 2/-82
5B-5		12/10/82	12/17/82	30	Comm. A-7	5.80	8	3:1 1:1	12.0 1.0	Commenced with A-7, 2/5/82
5B-6		12/6/82	12/17/82	30	Comm. A-7	2.33		1:1	3.5	
5B-7		12/14/82	12/17/82	30	7.33	.33		1:1	0.5	
5C-1		12/1/82	12/13/82	30	10.66	5.18	11	3:1 1:1	1.0 2.5	
5C-2		12/2/82	12/17/82	30	12.4	0	3	3:1	0	
5C-3		11/30/82	12/-/82	30	11.53					
5C-4		12/6/82	12/17/82	30	Comm. A-7	0				Plugged up with grout from 12/6/82
5C-5	1	12/10/82	12/17/82	30	Comm. A-7	0		1:1	0	
5C-6	1	12/7/82	12/17/82	30	Comm. A-7	.33		1:1	0.5	
6A-1	1	12/28/82	2/21/83	30	6.0	3.72	6	5:1	20.5	
6A-2	1	12/23/82	2/21/83	30	8.2	36.71	37	5:1 3:1 1:1	31 42 28.5	
6A-3	1	12/23/82	2/21/83	30	6.2					Grouted up already

APPENDIX H (CONTINUED)

NOSE No. 6		POWERHOUSE "NOSE" GROUTING DATA									
HOLE No. STATION	ZONE STAGE	DATE DRILLED	DATE GROUTED	ALONG HOLE FEET/100 FT	5 MINUTE WATER TAKE	TOTAL BAGS	BAGS USED	MIX	CUBIC FEET	NOTES:	
6A-4	1	12/20/82	2/21/83	30	5.8	8.33	10	5:1	12.5	MULTI SURFACE LEAKS	
6A-5	1	2/2/83	2/23/83	30	.01	0	3	3:1	0		
6A-6	1	2/10/83	2/23/83	30	.01	0		3:1	0		
6A-7	1	2/11/83	2/23/83	30	.12	0		3:1	0		
6A-8	1	2/11/83	2/23/83	30	4.4	.5		3:1	2.0		
6A-9	1	2/8/83	2/23/83	30	5.86	1.25		3:1	6.5	Communicated with 3-7 MULTI SURFACE LEAKS	
6A-10	1	2/8/83	2/23/83	30	2.0	.25	1	3:1	3.0		
6B-1	1	2/11/83	2/21/83	30	7.8	3.33	5	1:1	5.0	Communicated with 3-	
6B-2	1	12/20/82	2/21/83	30	7.3	7.0	5	1:1	10.5	Communicated with A-3, B-3, B-4, C-3, C-4	
6B-3	1	1/11/83	2/21/83	30	8.1					Grouted up already	
6B-4	1	2/11/83	2/21/83	30						Grouted up already	
6B-5	1	2/3/83	2/21/83	30						Grouted up already	
6B-6	1	2/4/83	2/21/83	30	.13	0		3:1	0		
6B-7	1	2/4/83	2/21/83	30	4.93	1.25	7	3:1	6.5	Communicated with A-9	
6B-8	1	2/2/83	2/23/83	30	Comm A-9	.42		3:1	1.5	Communicated with A-9	
6C-1	1	1/11/83	2/21/83	30	2.0	32.0	14	3:1 1:1	28.5 4.5	MULTI SURFACE LEAKS	
6C-2	1	12/20/82	2/21/83	30	6.0	5.66	7	1:1	8.5	Communicated with B-1, C-4	
6C-3	1	1/11/83	2/21/83	30	12.4					Grouted up already	
6C-4	1	2/2/83	2/21/83	30	-					Grouted up already	
6C-5	1	2/1/83	2/21/83	30	-					Grouted up already	

APPENDIX H (CONTINUED)

[illegible]

APPENDIX I

SUMMERIES OF NEGOTIATIONS

APPENDIX I

SUMMARIES OF NEGOTIATIONS

Modifications to Embankment Contract

P001 - Exploratory Core Borings Over 2300 LF - Mod A

The contract initially had an estimated quantity of 2300 linear feet of exploratory borings. Due to field conditions encountered, additional borings were desired. This modification provided for 3,100 linear feet of core borings, of which 2,329.2 LF were used.
Cost - \$91,723.90

P004 - Coarse Aggregate from Concrete Quarry - Mod I

This modification permitted the substitution of 3-inch concrete aggregate from the concrete dam quarry in lieu of its being obtained from embankment stockpiles of sound rock. Also, the Government's option not to process all sound rock in stockpile was deleted, i.e., all stockpiled rock was required to be processed.
Cost - \$00.00

P005 - Partial Payment for Stockpiled Materials - Mod J

Interim payment for stockpiled coarse filter and 3x20 sound and firm rock 60% of unit price. Payment recovered as material was used.
Cost - \$00.00

P007 - Remove Rocks and Trees - Mod Q

Directed removal of dead trees and loose rocks from river bank slope, upstream of dam on SC side, directed by SADEN-F. Install anchor block for barge line system.
Cost - \$514.00

P008 - Second Stage Dike VE - Mod D

Change in design for portion of 2nd stage cofferdike near tie-in with downstream cofferdike. Entire foundation was not excavated and treated, only toe trenches and cutoff trench under centerline.
Savings - \$9,763.40

P010 - Boyles Mobilization Disruption - Mod S

Payment for subcontractor's mobilization disruption caused by Government changes in decision on acceptability of foundation and its release for drilling and grouting.
Cost - \$3,690.00

APPENDIX I (CONTINUED)

P012 - Giant Fillet - Mod L

Placement of large, formed concrete fillet against the upstream slope of the South Carolina cutoff trench, after drilling and blasting.

Cost - \$36,372.00

P013 - Change Impervious Fill Slope - SC - Mod P

Steepened the interior slopes of the impervious, sand, and coarse filter in the South Carolina upstream notch, adjacent to concrete dam to better fit existing topography.

Cost - \$42,865.90

P014 - Add Grout Curtain Lines - Mod E

Provided 2 additional grout lines in highly weathered area of GA West, Station 11+80 to Station 13+00. Provide perimeter grout line from Station 5+85 to 6+50.

Cost \$131,550.000

P015 - Stockpile IWR - Mod U

Excavated IWR from upstream cofferdike and stockpiled it in the impervious borrow area for use in powerhouse switchyard. Lower upstream dike to elevation 350.

Cost - \$49,990.50

P016 - Impervious Borrow Test Trenches - Mod X

Excavated test trenches in impervious borrow area as directed by Government to investigate materials to be used following construction season.

Cost - \$8,900.00

P017 - Localized Foundation Treatment - Mod H

Specialized treatment for "Bathtub" area of GA West foundation, Station 5+50 to 6+60, approximately.

Cost - \$160,000.000

P018 - Additional Riprap in South Carolina - Mod V

Provided additional riprap protection for reference line area upstream to protect thin section of 3x20 rockfill. Also riprap in this area somewhat light compared to specifications.

Cost - \$25,000.000

P019 - Repair Closure Dike - Mod W

Minor repair to upstream closure dike, IWR section at east side of diversion channel, approximate elevation 370, during construction.

Cost - \$00.00

APPENDIX I (CONTINUED)

P021 - Change to Upstream Closure Dike - Mod M

Increased top elevation of upstream closure dike from 430.0 to 440.0, some rezoning.

Cost - \$647,800.00

P022 - Change Cofferdike Excavations - Mod K

Changed downstream cofferdike to remove entire section to elevation 305 rather than 320. Breach in upstream cofferdike not to be refilled. Upstream cofferdike available as source of IWR.

Cost - \$210,000.00

P023 - Alternate Access - Mod BB

Provided alternate access to diversion channel foundation upstream of cutoff trench so that preparation work could continue while access through cutoff trench was blocked by additional drilling and grouting.

Cost - \$9,250.00

P024 - Added Exploratory Borings - Mod CC

Perform 3-NX exploratory borings in diversion channel cutoff trench. Requested by EN-GC after subcontractor had demobilized.

Cost - \$11,500.00

P027 - Closure Dike Repair - Mod AA

Excavate and repair seepage area on the upstream slope of the upstream cofferdike, under Government direction.

Cost - \$110,000.000

P028 - Furnish and Place GA #89 Stone - Mod EE

Substitution of GA #89 stone for coarse filter in inclined drains. Government furnished stockpiled did not yeild required quantities.

Cost - \$421,197.65

P032 - Impervious Borrow Test Pits - Mod GC

Excavate and refill impervious borrow test pits, using Cat 245 backhoe as directed by Government.

Cost - \$1,040.000

P033 - Change Roller Feet - Mod LL

Replace existing sheepfoot roller feet with Southwest RR-95 type, to improve compaction characteristics.

Cost - \$7,208.00

APPENDIX I (CONTINUED)

P034 - Fines in Sound Rock Stockpile - Mod MM

Payment for settlement of claim for excessive amount of fines (minus #30 sieve) in the sound rock stockpiles.
Cost - \$411,410.00

P035 - Deletion of Coarse Filter Blanket - Mod HH

Deleted downstream coarse filter blanket above elevation 395 between Stations 17+00 and 20+00. Substituted with mass sand.
Savings - \$20,905.00

P036 - Embankment Foundations Delay - Mod RR

Payment of claim for embankment foundation delays during first stage diversion.
Cost - \$4,732,257.00

P037 - Delays to 2nd Stage Diversion - Mod SS

Payment of claim for delays in performing second stage diversion.
Cost - \$220,000.00

P038 - Post Diversion Foundation Delays - Mod TT

Payment of claim for foundation delays during second stage diversion, primarily in the diversion channel.
Cost - \$500,000.00

P039 - Change Impervious Fill Moisture Specs. - Mod II

Changed upper limit of moisture range for impervious-wet material from 3.0 to 5.5 percentage points above optimum.
Cost - \$00.00

P040 - Slope Protection for Upstream Mass Sand - Mod JJ

Provided slope protection for upstream mass sand slope between elevations 439 and 450, protection above closure dike top (440) during pool filling.
Cost - \$43,500.00

P041 - VE - Delete 8" Base Course - Mod NN

Accepted VE proposal to delete 8" base course on CA embankment. Substitute by raising minus 3-inch firm rock (top zone) the 8" to form base for pavement.
Savings - \$12,293.00

P043 - Deface Upstream Closure Dike - Mod QQ

Excavate 3 notches in face of upstream closure dike, through IWR and minus 3" firm rock, exposing rock fill. This will minimize erosion potential of embankment upstream sand zone during reservoir filling.
Cost - \$2,500.00

APPENDIX I (CONTINUED)

P044 - Additional Riprap, GA Embankment - Mod KK

Increase riprap thickness from 2 feet to 3 feet measured normal to embankment slope.

Cost - \$71,000.00

P045 - Riprap Paved Ditches - Mod UU

Provide riprap paved ditches, one along downstream GA embankment toe and one along the entire downstream SC embankment toe.

Cost - \$31,200.00

APPENDIX J

EARTH EMBANKMENTS

BORING LOGS

Grouting Efficiency Analysis

DRILLING LOG	DIVISION <u>Smith Atlantic</u>	INSTALLATION <u>CAHOON FALLS, SC.</u>	SHEET 1 OF 5 SHEETS
1. PROJECT <u>RICHARD B. RUSSELL DAM</u>		10. SIZE AND TYPE OF BIT <u>NWIX</u>	
2. LOCATION (Coordinates or Station) <u>4+81 C+10 W/S</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) <u>MSL</u>	
3. DRILLING AGENCY <u>SAVANNAH DISTRICT</u>		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number) <u>RE-12</u>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	
5. NAME OF DRILLER <u>CAMPBELL - (BOYLES BROS.)</u>		14. TOTAL NUMBER CORE BOXES <u>4</u>	
6. DIRECTION OF HOLE <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/> INCLINED <u>20°</u> DEG. FROM VERT. <u>S 55° W</u>		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN <u>25.8'</u>		16. DATE HOLE	
8. DEPTH DRILLED INTO ROCK <u>58.2'</u>		17. ELEVATION TOP OF HOLE <u>432.5</u>	
9. TOTAL DEPTH OF HOLE <u>89.0'</u>		18. TOTAL CORE RECOVERY FOR BORING <u>94</u>	
		19. INSPECTOR <u>CHARLES H. COMBS</u>	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	5		OVERBURDEN (CLAY FILL)			
	10					
	15					
	20					
409.1	25		Top of Rock 24.9			NOTE: SCALE CHANGE 25
	26		25.35 - 26.6 ACCUMULATED LOST CORE (1.2)	29 RQD C	Box 1	Pull 1 FROM 24.9 To 26.6 RUN 1.7 REC 0.5 CL 1.2
	27		26.6 VERTICAL BREAK - (WEATHERED) IRON STAINED NUMEROUS, HORIZONTAL.			Pull 2 FROM 26.6 To 29.8 RUN 3.2 REC 3.2 CL C.C
	28		27.6' - 28.8' VERY WEATHERED QUARTZ - FELDSPAR HORNBLENDE META DACITE	100 RQD C		
	29		CONTINUED ON SHEET 2			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE
432.5

Hole No. RE-12

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CAUTION FALLS, S.C.

SHEET 2

OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	29.8		METADACITE LIGHT GRAY, FINE GRAINED SLIGHTLY PORPHYRITIC, PITTED WITH IRON STAINING VARIANTS FE-MG MICAS	100	BOX 1	PULL 2 (CONTINUED)
	30			30.3		PULL 3 FROM 29.8 REC 0.5 TO 30.3 CL 0.0 RUN 0.5
	31					PULL 4 FROM 30.3 TO 35.4 RUN 5.1 REC 5.1 CL 0.0
	32		31.9' SUBHORIZONTAL FRACTURE, SMALL AMOUNT OF GROUT	100 RQD 100		
	33					
	34					NOTE: SCALE CHANGE @ 34.0
	35.4		35.4-35.7 ACCUMULATED LOST CORE (0.3')			PULL 5 FROM 35.4 REC 1.4 TO 37.1 CL 0.3 RUN 1.7
396.8	36		(CORE DIVIDED BETWEEN META-DACITE AND META-DIABASE) WITH NUMEROUS HEALED HIGH ANGLE FRACTURES	82 RQD 0 37.1		
	38		37.1-39.0 ACCUMULATED LOST CORE 1.9	53 RQD 0		PULL 6 FROM 37.1 REC 2.1 TO 41.1 CL 1.9 RUN 4.0
	40		CONTINUED ON SHEET 3			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE
432.5

Hole No. RE-12

PROJECT
RICHARD B. RUSSELL DAM

INSTALLATION
CALHOUN FALLS S.C.

SHEET 4
OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	58.0		PORPHYRITIC METADACITE LIGHT GREEN - FINE GRAINED PORPHYRITIC		Box 2	PULL 11 (CONTINUED)
			58.2 - 58.6 HEALED HIGH ANGLE FRACTURES (TWO)	100 RQD 78	60.0 Box 3	FROM 57.0 TO 61.8 RUN 4.8 REC 4.8 CL 0.0
	60.0					
			61.8 - 62.5 OPEN HIGH ANGLE FRACTURES FACES CONTAIN MINOR AMOUNTS OF MUSCOVITE, PYRITE OR OTHER IRON SULFIDE MIN- ERALS	61.8		PULL 12 FROM 61.8 REC 4.7 TO 66.5 CL 0.0 RUN 4.7
	62.0			100 RQD 53		
	64.0					
					66.5	
	66.0					PULL 13 FROM 66.5 TO 70.9 RUN 4.4 REC 4.4 CL 0.0
			68.5 - 69.2 HEALED HIGH ANGLE FRACTURE	100 RQD 28		
	68.0					
			69.0 - 70.8 OPEN HIGH ANGLE FRACTURE			
	70.0			70.9		PULL 14 FROM 70.9 TO 76.9 RUN 6.0 REC 6.0 CL 0.0
			70.9 - 72.2 BREAK EVERY 0.1' - 0.2' (PROBABLY BY DRILL ACTIVITY)			
	72.0			100 RQD 58		
	74.0					
			75.9' GROUT ON BREAK NOR- MAL TO HOLE AXIS		75.9	
	76.0		CONTINUED ON SHEET 5			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 432.5		Hole No. RE-12		
PROJECT RICHARD B. RUSSELL DAM		INSTALLATION CALHOUN FALLS, S.C.		SHEET 5 OF 5 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	76		PORPHYRITIC META-DACITE		Box 4	Pull 14 (CONTINUED)
	76.3 - 76.6		OPEN HIGH ANGLE FRACTURE			Pull 15
	78		77.8 - 78.4 OPEN HIGH ANGLE FRACTURE	100		FROM
				RQD		TO
				82		RUN 4.7
						REC 4.7
						CL 0.0
	80		80.3 - 80.9 BREAK PROBABLY HIGH ANGLE FRACTURE WITH FURTHER BREAKAGE BY DRILL ACTIVITY			Pull 16
	82			100		FROM 81.5'
				RQD		TO 84.9'
			82.3 - 82.4 BREAK NORMAL TO HOLE AXIS	97		RUN 3.4
						REC 3.4
						CL 0.0
	84		BOTTOM OF BORING 84.9			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION ELBERTON, GA.		SHEET OF 3 SHEETS	
1. PROJECT RICHARD B. RUSSELL				10. SIZE AND TYPE OF BIT NWX			
2. LOCATION (Coordinates or Station)				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL SIMCO ROTARY			
4. HOLE NO. (As shown on drawing title and file number)				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED UNDISTURBED	
5. NAME OF DRILLER BRETT CAMPBELL (BOYES BROS.)				14. TOTAL NUMBER CORE BOXES 2		15. ELEVATION GROUND WATER	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				16. DATE HOLE 19 JUNE 1980		STARTED COMPLETED 20 JUNE 80	
7. THICKNESS OF OVERBURDEN 0				17. ELEVATION TOP OF HOLE 368.9		18. TOTAL CORE RECOVERY FOR BORING 91 %	
8. DEPTH DRILLED INTO ROCK 25.7				19. INSPECTOR T.A. POPE			
9. TOTAL DEPTH OF HOLE 25.7							

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
368.9	0					
	1		QUARTZ FELDSPAR GNEISS WITH 5% CHLORITE, SOME PINK FELDSPAR. LIGHT GRAY BROWN, SEVERELY TO BADLY WEATHERED AND STAINED GRAVEL SIZED FRAGMENTS.	41 RGD C	Box 1	Pull 1 FROM C.C. TO 3.4' RUN 3.4' REC 1.4' CL 2.0'
	2		GFG AS ABOVE, WITH LARGER SEGMENTS			
	3		3.25 - 3.6 JOINT WEATH/STAINED			
	4		3.35 - 3.45 " " "			
	5		3.7 - 3.85 2 INTERSECTING JOINTS			
	6		3.8 - 4.45 ZONE OF BADLY WEATHERED AND BROKEN GRAVEL SIZED FRAGMENTS			
	7		WEATHERED AND STAINED JOINTS AT 4.45 - 4.65, 4.95 - 5.0, 5.0 - 5.25, 5.3 - 5.8	100 RGD 58		Note: SCALE CHANGE AT 5.0'
	8		5.35 - 5.85 TWO INTERSECTING STAINED JOINTS			Pull 2 FROM 3.4' TO 7.9' RUN 4.5' REC 4.5' CL 0.0'
	9		6.3 - 7.9 CORE BROKEN INTO GRAVEL AND SMALL COBBLE-SIZED PIECES BY NUMEROUS HIGH AND LOW ANGLE JOINTS			Pull 3
359.9	9		7.9' - 11.9' CORE BROKEN INTO GRAVEL SIZED FRAGMENTS - POOR RECOVERY			
CONTINUED ON SHEET 2						

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No.		
PROJECT		INSTALLATION		SHEET		
RICHARD B. RUSSELL		ELBERTON GA.		2 OF 3 SHEETS		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
359.9	9b	c	d	e	f	g
			QUARTZ FELDSPAR GNEISS (AS DESCRIBED)		Box 1	Pull 3 (CONTINUED)
	10			40 RQD 0		FROM 7.9' TO 11.9' RUN 4.0' REC 1.6' CL 2.4'
	11					
	12		11.9'-12.3' CORE BROKEN INTO GRAVEL SIZED PIECES BY SEVERAL INTERSECTING, WEATHERED JOINTS.			Pull 4
	13		NEAR HORIZONTAL JOINTS, ALL WEATHERED AND STAINED AT: 12.3, 12.75, 12.95, 13.0 WEATH. AND STAINED JOINTS AT 13.35 - 13.45, 13.55 - 13.55			FROM 11.9 TO 16.4 RUN 4.5 REC 4.5 CL 0.0
	14		13.55 - 13.9 BROKEN INTO GRAVEL SIZED PIECES.	100 RQD 73		NOTE: AT APPROX 12' DEPTH, DRILL WATER LEAKS FROM SURFACE A CRACK 5' AWAY.
	15		14.0' MODERATELY WEATHERED WITH PARTIALLY HEALED SOLUTION JOINTS			
	16		14.2' - 14.4' STAINED JOINT WITH PINK ZEOLITE JOINT WITH EPIDOTE, OPEN AND STAINED 14.65 - 15.3 HEALED 15.3 - 15.7 15.7 LOW ANGLE STAINED JT. 16.2' - 16.5' IRREGULAR BREAK LINED WITH ZEOLITE			
	17		16.4' - 16.75 SEVERAL JOINTS WITH FINE SAND			
351.9						
CONTINUED ON SHEET 2-						

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

368.9

Hole No. RE-14

PROJECT

RICHARD B. RUSSELL

INSTALLATION

ELBERTON GA.

SHEET 3

OF 3 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV. ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
351.9	17.6	c	d	e	f	g
			QUARTZ FELDSPAR GNEISS AS DESCRIBED			Pull 5
			16.95 - 17.05 JOINTS WITH FINE SAND		17.5'	FROM 16.4'
						To 21.0'
			17.2 MECHANICAL BREAK ALONG HEALED CHLORITIC JOINT		Box 2	RUN 4.6'
			18.95 - 19.25 JOINT WITH EPIDOTE AND MANGANESE OX.	100 RQD 38		REC 4.6'
						CL 0.0'
			19.2 MECHANICAL BREAK			
			19.75 - 19.9 MUD AND MN OXIDE IN IRREGULAR BREAK			
			20.3 - 20.8 2 VUGGY JOINTS WITH MANGANESE OXIDE			
			20.9 - 21.0 SEVERAL JOINTS FRAGMENTED ROCK			
			21.1' - 21.3 INTERSECTING JOINTS WITH ZEOLITE			Pull 6
			21.85 MECHANICAL BREAK			FROM 21.0'
				100 RQD 89		To 25.7'
						RUN 4.7'
						REC 4.7'
						CL C.C.
			23.15 OPEN JOINT			
			24.15 - 24.4 ZONE OF BROKEN AND STAINED ROCK			
			24.7 LOW ANGLE JOINT. STAINED			
			25.25 - 25.35 STAINED JOINT			
343.2			BOTTOM OF BORING 25.7'			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION CALHOUN FALLS, S.C.		SHEET OF 4 SHEETS	
1. PROJECT RICHARD B. RUSSELL PROJECT				10. SIZE AND TYPE OF BIT			
2. LOCATION (Coordinates or Station) 9+23				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) RE-22				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED UNDISTURBED	
5. NAME OF DRILLER BOYLES BROS. DRILLER				14. TOTAL NUMBER CORE BOXES 7		15. ELEVATION GROUND WATER	
6. DIRECTION OF HOLE <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/> INCLINED 20° DEG. FROM VERT.				16. DATE HOLE		STARTED COMPLETED	
7. THICKNESS OF OVERBURDEN 0.0				17. ELEVATION TOP OF HOLE 392.0		18. TOTAL CORE RECOVERY FOR BORING NA	
8. DEPTH DRILLED INTO ROCK 97.9				19. INSPECTOR CHARLES H. COMBS			
9. TOTAL DEPTH OF HOLE 97.9							

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of wash, etc., if significant)
392.0	0					
	1		0.0-0.65 BROKEN PROBABLY BY DRILL ACTION		Box 1	Pull 1 FROM 0.0' TO 5.0' RUN 5.0' REC 4.7' CL 0.3'
	2		0.65-1.3 OPEN HIGH ANGLE FRACTURE, MOD. SMOOTH, SMALL AMOUNT OF GROUT ON FACES. POSSIBLY OPENED BY DRILL ACTION	94		
	3		2.0-2.3 HEALED HIGH ANGLE	RQD		
	4		META. DIABASE	48		
	5		DIKE, MODERATELY HARD APHANITIC, HOMOGENOUS, DARK GRAY-GREEN			
	6		4.7'-5.0' ACCUMULATED LOST CORE (0.3)	5.0'		Pull 2 FROM 5.0' TO 10.0' RUN 5.0' REC 4.9' CL 0.1'
	7			98		
	8			RQD		
	9			68		
	10		8.0-8.5 OPEN HIGH ANGLE FRACTURE. TITANIUM STAINED SMOOTH			Pull 3 FROM 10.00 TO 14.05 RUN 4.05 REC 4.05 CL 0.0
	11		9.15 BREAK (<0.05)			
	12		10.0' ACCUMULATED LOST CORE (0.1)	10.0'		
	13		12.15-12.5 OPEN HIGH ANGLE FRACTURE, MOD. SMOOTH			
			12.3-12.95 HEALED HIGH ANGLE FRACTURE SMOOTH TI STAINED, CALCITE FILLED			
			CONTINUED ON SHEET 2			

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		392.0		Hole No. RE-22	
PROJECT			INSTALLATION			SHEET 2		
RICHARD B. RUSSELL PROJECT			CAUTION FALLS, S.C.			OF 4 SHEETS		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVER- ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)		
a	13b	c	d	e	f	g		
		+ + +	META DIABASE (AS DESCRIBED)		Box 1			
	14	+ + +	13.4' - 13.75 OPEN HIGH ANGLE FRACTURE, MOD. SMOOTH TITANIUM STAINED	14.05		Pull 4		
	15	+ + +				FROM 14.05		
						TO 17.95		
						RUN 3.9		
						REC 3.9		
						CL 0.0		
	16		14.6' PERPHYRITIC META-DACITE MASSIVE, NUMEROUS PHENO- CRYSTS, QUARTZ AND FELD- SPAR, PORPHYRITIC, LIGHT GRAY, FRESH, HARD, IRON- MAGNESIUM MICAS, FINE GRAINED	RQD	16.0 Box 2			
	17							
	18			17.95				
				RQD		Pull 5		
	19			18.70		FROM 17.95		
						TO 18.70		
						RUN 0.75		
						REC 0.75		
						CL 0.0		
	20							
	21			RQD		Pull 6		
				76		FROM 18.70		
						TO 23.15		
						RUN 4.45		
						REC		
						CL		
	22							
	23			23.15				
				23.70		Pull 7		
	24					FROM 23.15		
						TO 23.70		
						RUN 0.55		
						REC		
						CL		
	25			RQD		Pull 8		
				79		FROM 23.7		
						TO 27.8		
						REC		
						CL		
	26					Pull 9		
				27.08		FROM 27.1		
						TO 29.1		
						REC		
						CL		
	27			RQD		Pull 10		
				100		FROM 27.1		
						TO 29.1		
						REC		
						CL		
	28			29.05				
	29							
	30							

Continued on Sheet 3

J-11

Continued on Sheet 3

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 392.0		Hole No. RE-22	
PROJECT RICHARD B. RUSSELL PROJECT			INSTALLATION CALHOUN FALLS, S.C.			SHEET 3 OF 4 SHEETS
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		PORPHYRITIC METADACITE (AS DESCRIBED)	RQD 84	30.8 Box 3	Pull 10 FROM 29.1 REC 4.9 TO 34.0 CL 0.0 RUN 4.9 NOTE: SCALE CHANGE @ 30.0
	32					
	34			33.95 100 RQD 63 36.5 100 RQD 70 38.7		Pull 11 FROM 33.95 REC 0.95 TO 34.9 CL 0.0 RUN 0.95
	36					Pull 12 FROM 34.9 REC 1.6 TO 36.5 CL 0.0 RUN 1.6
	38					Pull 13 FROM 36.5 REC 2.2 TO 38.7 CL 0.0 RUN 2.2
	40					
	42					
	44					
	46					
	48					
	50					
	52		52.8 - 53.1 OPEN HIGH ANGLE FRACTURE, MOD. SMOOTH	52.8		
	54			100		Pull 18 FROM 52.8 REC 4.7 TO 57.5 CL 0.0 RUN 4.7
	56	+	METADIABASE	55.0 RQD 66		
	58	+	57.0 - 57.2 OPEN HIGH ANGLE FRACTURE (COMPOUND) MOD. SMOOTH, MODERATELY TITANIUM STAINED	57.5 100 RQD		Pull 19 FROM 57.5 TO 62.4 RUN 4.9 REC 4.9 CL 0.0
	60	+	60.65 - 60.9 OPEN HIGH ANGLE FRACTURE, SMOOTH, PARTIALLY FILLED	80	60.5 Box 5	
	62	+	61.6 - 61.85 "	62.35		
	64	+	62.1 - 62.15 "			Pull 20
		+	63.0 - 66.8 NUMEROUS HEALED HIGH ANGLE FRACTURES			
			CONTINUED ON SHEET 4			

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. RE-22	
PROJECT			INSTALLATION		SHEET 4	
RICHARD B. RUSSELL PROJECT			CAUTION FALLS, SC.		OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	64	+	METADIABASE	100	Box 5	Pull 20 (CONT'D)
	66	+	CORE CAN BE BROKEN BY HAND ALONG HEALED FACES 62.0-67.0	RQD 0		FROM 62.35 REC 4.9 To 67.25 CL 0.0 RUN 4.9
	68	+	METADIABASE (PORPHYRITIC)	67.0-67.25		Pull 21
	70	+				FROM 67.25 To 77.00 RUN 9.75 REC 9.75 CL 0.00
	72	+		100 RQD 96		
	74	+				
	76	+			75.8 Box 6	Pull 22
	78	+	METADIABASE	100 RQD 100 79.0		FROM 77.0 REC 2.0 To 79.0 CL 0.0 RUN 2.0
	80	+		100 RQD 58		Pull 23
	82	+		83.4-83.9		FROM 79.0 To 83.9 RUN 4.9 REC 4.9 CL 0.0
	84	+	PORPHYRITIC METADIABASE			Pull 24
	86	+		100 RQD 60		FROM 83.9 To 88.9 RUN 5.0 REC 5.0 CL 0.0
	88	+		88.9		
	90	+		90.7	90.9 Box 7	Pull 25
	92	+	METADIABASE	100 RQD 100		FROM 88.9 REC 4.9 To 93.8 CL 0.0 RUN 4.9
	94	+		93.8		Pull 26
	96	+		100 RQD 100		FROM 93.8 REC 4.1 To 97.9 CL 0.0 RUN 4.1
		+	BOTTOM OF BORING 97.9			

DRILLING LOG		DIVISION		INSTALLATION		Hole No. RE-23	
		SOUTH ATLANTIC		CALHOUN FALLS, S.C.		SHEET 1 OF 5 SHEETS	
1. PROJECT RICHARD B. RUSSELL DAM				10. SIZE AND TYPE OF BIT MSL			
2. LOCATION (Coordinates or Station) 9+44				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) RE-23				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		13. DISTURBED UNDISTURBED	
5. NAME OF DRILLER BOXES BROS.				14. TOTAL NUMBER CORE BOXES 7			
6. DIRECTION OF HOLE <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/> INCLINED 20° DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.0				16. DATE HOLE STARTED COMPLETED			
8. DEPTH DRILLED INTO ROCK 96.5				17. ELEVATION TOP OF HOLE 392.4			
9. TOTAL DEPTH OF HOLE 96.5				18. TOTAL CORE RECOVERY FOR BORING 84 %			
				19. INSPECTOR CHARLES H. COMBS			

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
			METADIABASE DIKE MATERIAL, MODERATELY HARD TO HARD, APHANITIC, DARK, HOMOGENOUS, DARK GRAY-GREEN 0.8 - 1.1 HIGH ANGLE FRACTURE, SMOOTH, MODERATELY FRESH. 1.4 - 1.5 HIGH ANGLE FRACTURE OPEN, MOD. SMOOTH, MOD. WEATHERED, BROKEN CLAY COATING ON FACES		Box 1	Pull 1 FROM 0.0 TO 4.9 RUN 4.9
	2.9'		METADACITE MASSIVE, DARK, HOMOGENOUS METAMORPHOSED IGNEOUS ROCK MODERATELY HARD TO HARD, FINE GRAINED, LIGHT GRAY, FRESH, SLIGHTLY PORPHYRITIC TO PORPHYRITIC 4.15 - 4.3 BROKEN PROBABLY BY DRILL ACTION 4.85 - 5.13 - 5.3 SUB-HORIZONTAL FRACTURES 5.3 - 5.5 HIGH ANGLE FRACTURE, MOD. TITANIUM STAINED, SMOOTH			Pull 2 FROM 4.9 TO 8.3 RUN 3.4
			CONTINUED ON SHEET 2			

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 392.4		Hole No. RE-23	
PROJECT RICHARD B. RUSSELL DAM			INSTALLATION CAUTION FALLS S.C.		SHEET 2 OF 5 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	6		META-DACITE (AS DESCRIBED)		Box 1	PULL 2 (CONTINUED) NOTE: SCALE CHANGE @ 6.0
	8			8.3		
	10			RQD 96		PULL 3 FROM 8.3 TO 10.8 RUN 2.5
	12			10.8		
	14			RQD 71.4		PULL 4 FROM 10.8 TO 15.7 RUN 4.9
	16		14.55-14.7 HIGH ANGLE FRACTURE, MOD. STAINING, BROKEN BY DRILL ACTIVITY	15.7	15.0 Box 2	PULL 5 FROM 15.7 TO 20.5 RUN 4.8
	18			RQD 95.8		
	20		19.0-19.15 HIGH ANGLE FRACTURE, TITANIUM STAINED, SMOOTH, IRON OXIDE COATING	20.5		
	22		21.25-21.45 SUBHORIZONTAL FRACTURES, MOD. SMOOTH SOME ARE OPEN	RQD 85.4		PULL 6 FROM 20.5 TO 25.3 RUN 4.8
	23		CONTINUED ON SHEET 3			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

392.4

Hole No. RE-23

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CAUTION FALLS S.C.

SHEET 3

OF 5 SHEETS

ELEVATION a	DEPTH 23b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	23		META DACITE (AS DESCRIBED)		Box 2	Pull 6 (CONTINUED)
	25		23.0 - 23.25 HIGH ANGLE FRACTURE MOD. SMOOTH	29.3		
	27			RQD 94.9		Pull 7 FROM 29.3 To 30.2 RUN 4.9
	29					
	31			30.2	30.2	
	33			RQD 100	Box 3	Pull 8 FROM 30.2 To 33.0 RUN 2.8
	35			33.0		
	37			RQD 85.1		Pull 9 FROM 33.0 To 37.7 RUN 4.7
	39		37.7 - 38.25 HIGHLY FRACTURED - PROBABLY THROUGH DRILL ACTION	37.7		
			38.75 - 39.45 METADACITE CUT BY APPROX. VENT METADIABASE DIKE ~ 0.1' THICK	RQD 84.3		Pull 10 FROM 37.7 To 42.8 RUN 5.1
41			CONTINUED ON SHEET 4	5-16		

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

392.4

Hole No. RE-23

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CAUTION FALLS, S.C.

SHEET 4

OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		METADACITE (AS DESCRIBED)		Box 3	Pull 10 (CONTINUED) NOTE: SCALE CHANGE @ 40.0
42			(GRADATIONAL CONTACT)	42.8		
44			PORPHYRITIC META-DACITE MASSIVE, DENSE, META-IGNEOUS, HARD, LIGHT GRAY-GREEN, FRESH, NUMEROUS QUARTZ & FELDSPAR PHENO- CRYSTS	RQD 82.3 47.6	45.7 Box 4	Pull 11 FROM 42.8 To 47.6 RUN 4.8
46						
48			44.9 - 45.2 HIGH ANGLE FRACTURE, SMOOTH, SLIGHTLY ALTERED	RQD 89.7		Pull 12 FROM 47.6 To 52.5 RUN 4.9
50			49.85 - 50.2 SUBHORIZONTAL FRACTURE PARTIALLY FILLED WITH GROUT?	52.45		
52			54 HIGH ANGLE FRACTURE SMOOTH, SLIGHTLY ALTERED	RQD 86.6		Pull 13 FROM 52.5 To 57.3 RUN 4.8
54			54.1 - 54.5 } HIGH ANGLE 55.3 - 55.55 } FRACTURES 55.65 - 55.90 } SL. ALTERED	57.3		
56			58.6 - 58.9 } HEALED HIGH 59.2 - 59.5 } ANGLE FRACTURES SMOOTH	RQD 100		Pull 14 FROM 57.3 To 61.8 RUN 4.5
58				61.75	61.0 Box 5	
60			METADIABASE (AS DESCRIBED)	RQD 57.7		Pull 15 FROM 61.8 To 66.6 RUN 4.8
62			NUMEROUS HEALED HIGH ANGLE FRACTURES EVERY 0.1' - 0.4' MAJORITY FILLED WITH CALCITE	66.6		
64			65.4 - 66.0 OPEN FRACTURES ALONG CORE AXIS - MOD. SMOOTH (PROBABLY STRESS-RELIEF FRACTURE) COULD ALSO BE HYDROFRACTURE	RQD 76.9 71.15		Pull 16 FROM 66.6 To 71.2 RUN 4.6
66			68.6 - 68.8 SUBHORIZONTAL FRACTURE, OPEN, PARTIALLY FILLED WITH CALCIUM CARB- ONATE	RQD 60.6		Pull 17 FROM 71.2 RUN 4.9 To 76.1
68			PORPHYRITIC META-DACITE AS DESCRIBED	5-17		
70			73.3 - 73.6 HIGH ANGLE FRACTURE, OPEN, CALCITE FILLED, SMOOTH			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE
392.4

Hole No. RE-23

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 5

OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	74.6	+	METADIABASE (AS DESCRIBED)		Box 5	Pull 17 (CONTINUED)
	76	+		76.1	Box 6	Pull 18
	78	+		RQD 100		FROM 76.1 To 81.1 RUN 5.0
	80	+		81.05		
	82	+	81.9' OPEN SUB-HORIZONTAL FRACTURE GROUT FILLED	RQD 100		Pull 19
	84	+	83.75 - 84.15 HIGH ANGLE FRACTURE, SMOOTH CALCITE COATING	85.6		FROM 81.1 To 85.6 RUN 4.5
	86	+				Pull 20
	88	+	87.5 - 87.85 HIGH ANGLE FRACTURE, SMOOTH - CALC COATING	RQD 53.7		FROM 85.6 To 90.4 RUN 4.8
	90	+		90.35		
	92	+		RQD 100	Box 7	Pull 21
	94	+		95.1		FROM 90.4 To 95.1 RUN 4.7
	96	+	BOTTOM OF BORING 96.5'	RQD 100 96.5		Pull 22
						FROM 95.1 TO 96.5 RUN 1.4

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION CAUTION FALLS, S.C.		SHEET 1 OF 1 SHEETS	
1. PROJECT RICHARD B. RUSSELL DAM				10. SIZE AND TYPE OF BIT NWX			
2. LOCATION (Coordinates or Station) 6+21				11. DATUM FOR ELEVATION SHOWN (TBM or MSL)			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) RE-39				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED UNDISTURBED	
5. NAME OF DRILLER				14. TOTAL NUMBER CORE BOXES 6			
6. DIRECTION OF HOLE <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/> INCLINED 30° DEG. FROM VERT.				15. ELEVATION GROUND WATER		16. DATE HOLE STARTED COMPLETED	
7. THICKNESS OF OVERBURDEN 0.0				17. ELEVATION TOP OF HOLE 3901			
8. DEPTH DRILLED INTO ROCK 91.9				18. TOTAL CORE RECOVERY FOR BORING NA			
9. TOTAL DEPTH OF HOLE 91.9				19. SIGNATURE OF INSPECTOR JAMES E. BOLEN (SEE NOTES 1 & 3 SHEET 2)			

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	1		METADIABASE (DIKE MATERIAL) HIGHLY FRACTURED AND WEATHERED (PULL 1)		Box 1	Pull 1 FROM 0.0 TO 4.6 RUN 4.6
	2		GROUT			
	3		GROUT POSSIBILITY DARK BROWN METALLIC RUST			
	4		GROUT			
	5		CORE LOSS	4.6		Pull 2 FROM 4.6 TO 10.0 RUN 5.4
	6		FRACTURE COATED WITH TAN TO DARK BROWN STAIN			
	7		GROUT			
	8		GROUT			
	9					
	10		GROUT HEALED FRACTURE FB	10.0		Pull 3 FROM 10.0 TO 13.1 RUN 3.1
	11		GROUT FG			
	12		PYRITE CRYSTAL CONTACT GROUT			
	13		Continued on SHEET 2			

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DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE
390 ±

Hole No. RE - 39

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS S.C.

SHEET 2

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	13			13.1	Box 1	Pull 4 FROM 13.1 To 17.9 RUN 4.8
	14		FROM 13.5 TO 14.6 FRACTURES ARE COATED WITH LIGHT RUST			
	15		FRAGMENTED AREA SOME GROUT POSSIBLE			
	16		LIGHT BROWN RUST YELLOWISH-GREEN TO METALLIC RUST WITH SMALL FAN PYRITE CRYSTALS		Box 2	
	17		SEVERAL LARGE PYRITE CRYSTALS BROKEN THROUGH HEALED FRACTURE	17.9		
	18		FB WITH A FEW SMALL PYRITE CRYSTALS			Pull 5 FROM 17.9 To 22.9 RUN 5.0
	19		FB PYRITE CRYSTALS			
	20		0.05 GROUT FILLED JOINT RUST			
	21					
	22		GROUT RUST			
	23		YELLOW GREEN PYRITE CRYSTALS CORE SPIN PYRITE CRYSTALS	22.9		
	24		GROUT FILLED			Pull 6 FROM 22.9 To 25.9 RUN 3.0
	25		GROUT AND RUST - DARK RUST			
	26		DARK RUST			
	27		RUSTY WITH PYRITE			
	28		FB PYRITE			
	29		WHITE CHALK	25.9		
	30		GREENISH RUST			Pull 7 FROM 25.9 To 28.2 RUN 2.3
	31		GREENISH AND PYRITE			
	32		CORE LOSS	28.2		
	33		BADLY FRAGMENTAL > 1/4" TO 2" APPROX 50% CORE LOSS MOST BREAKS RUSTY BUT A LITTLE OF WHITE CHALKY MATERIAL			
	34					
	35		CORE LOSS			Pull 8 FROM 28.2 To 33.1 RUN 4.9
	36		DIRTY DUSTY RUST			
	37		DULL BROWN RUST STAIN			
	38					
	39		CONTINUED ON SHEET 3	J-20		

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

390±

Hole No. RE-39

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 3

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30				Box 3	Pull 8 (CONTINUED)
31						
32						
33		FB	CHALKY WHITE MATERIAL	33.1		
34			BRIGHT RUST DULL RUST BRIGHT RUSTY DARK METALLIC SOME GROUT?			Pull 9 FROM 33.1 TO 37.7 RUN 4.6
35			GREENISH RUST WHITE CHALKY			
36			BLACK METALLIC HEALED			
37		FB	GREENISH WITH PYRITE	37.7		
38			BLACK METALLIC MATERIAL PYRITE FB FB			Pull 10 FROM 37.7 TO 42.5 RUN 4.8
39			WHITE CHALKY BLACK METALLIC HEALED JOINT			
40						
41						
42			CORESPIN	42.5		
43						Pull 11 FROM 42.5 TO 47.4 RUN 4.9
44			BOTH APPEAR FRESH BUT HAVE VERY LIGHT WHITE COLOR			
45			CHALKY WHITE			
46			FB LOWER BREAK QUARTZ CRYSTAL LIGHT GREEN TINT WITH PYRITE			
47			CONTINUED ON SHEET 4		Box 4	

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DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

390 ±

Hole No RE-39

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 4

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	47.4			47.4	Box 4	
	48		FB			Pull 12
			WHITE GRAY			FROM 47.4
			LIGHT GREEN TINT			TO 51.0
	49		LIGHT GRAY LOOKS LIKE GROUT BUT NOT			RUN 3.6
			1/2" QUARTZ SEAM			
	50		FG SOME VERY LIGHT GRAY			
			- COATING - SEVERAL			
			QUARTZ FILLED JOINTS			
			PULL 12	51.0		
	51					Pull 13
						FROM 51.0
						TO 54.2
						RUN 3.2
	52					
	53					
	54		BLACK SOOTY WITH SEVERAL PYRITE CRYSTALS	54.2		Pull 14
						FROM 54.2
						TO 59.0
						RUN 4.8
	55		REDISH			NOTE: BAD DRILLING - DIAMETER OF CORE GREATLY RE- DUCED
			PALE GRAY			
	56					
	57		DARK ALMOST BLACK FB?			
	58		PALE GRAY - SEVERAL HEALED FRACTURES IN THE AREA			
			REDDISH - RUST WITH CHALKY WHITE			
	59		GROUT	59.0		Pull 15
			FB			FROM 59.0
	60		DARK FB			TO 65.1
			DULL GRAY			RUN 6.1
	61					
	62		DULL GRAY FB		62.6	
					Box 5	
	63					
	64		CONTINUED ON SHEET 5			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

390 ±

Hole No. RE-39

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 5

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	64		FB		Box 5	Pull 15 (CONTINUED)
	65		DULL METALLIC BLACK FB WITH PYRITE	65.1		
	66					Pull 16
	67					FROM 65.1 TO 69.9 RUN 4.8
	68		Pull 16 Appears ALL BREAKS ARE FRESH WITH PYRITE CRYSTALS			
	69					
	70		DARK COLOR WITH PYRITE ONE HEALED FRACTURE OVER 3' LONG	69.9		Pull 17
	71		PYRITE			FROM 69.9 TO 74.8 RUN 4.9
	72		LIGHT GRAY			REC CL
	73		LIGHT GRAY TO WHITE GROUT POSSIBILITY			
	74		PYRITE METALLIC GRAY LIGHT GRAY WITH BAND OF PYRITE - LIGHT GRAY			
	75		GROUT POSSIBILITY - PYRITE	74.8		Pull 18
	76		GREENISH - METALLIC - PYRITE			FROM 74.8 TO 79.6 RUN 4.8
	77		SLIGHT GREENISH TINT METALLIC WITH PYRITE		77.2 Box 6	REC CL
	78		METALLIC WITH SEVERAL PYRITE CRYSTALS			
	79		GRAY SOME WHITE - MOSTLY DARK METALLIC WITH A FEW	79.6		Pull 19
	80		DARK METALLIC			
	81		GREENISH DARK METALLIC LIGHT GRAY			
			CONTINUED ON SHEET 6			
				J-23		

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 390±		Hole No. RE-39		
PROJECT RICHARD B. RUSSELL DAM		INSTALLATION CAHOON FALLS, S.C.		SHEET 6 OF 6 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	81		GRAY TO DULL METALLIC WITH PYRITE		Box 6	Pull 19 FROM 79.6 TO 84.5 RUN 4.9
	82					
	83		PALE GRAY COATING WITH PYRITE CRYSTALS			
	84			84.5		
	85					Pull 20 FROM 84.5 TO 89.3 RUN 4.8
	86		HEALED FRACTURE			
	87					
	88		FB QUARTZ AND PYRITE			
			FB LIGHT GRAY. PYRITE			
	89		FB PYRITE	89.3		
	90		LOWER 20' OF CORE HAS NUM- EROUS HEALED FRACTURES, GRAY- WHITE FILLED, FROM 1/16" TO 3/8" AVERAGE ABOUT 1/4".			Pull 21 FROM 89.3 TO 91.9 RUN 2.6
	91					
			BOTTOM OF BORING 91.9	91.9		
<p>NOTES:</p> <p>1) JAMES E. BOLEN DID NOT PHYSICALLY INSPECT THE CORE DEPICTED ON THIS LOG. AN ATTEMPT WAS MADE ON HIS BEHALF TO REPRODUCE AN EARLIER COPY OF THIS LOG INTO A FORM MORE FREQUENTLY USED BY THE SAVANNAH DISTRICT.</p> <p>2) A GRAPHIC LEGEND WAS USED IN LIEU OF THE STANDARD "ROCK" LEGEND PRESUMABLY FOR THE PURPOSE OF ILLUSTRATING JOINTS AND OTHER ROCK DIS-CONTINUITIES.</p> <p>3) THE AUTHOR OF THE ORIGINAL LOG WAS NOT DOCUMENTED AND IS AT THIS WRITING (JAN 1987) UNKNOWN.</p>						

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1	
1. PROJECT		SOUTH ATLANTIC	CAULHOUN FALLS S.C.	OF 6 SHEETS	
2. LOCATION (Coordinates or Station)		45+72	10. SIZE AND TYPE OF BIT	NWX	
3. DRILLING AGENCY		SAVANNAH DISTRICT	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL	
4. HOLE NO. (As shown on drawing title and file number)		RE-40	12. MANUFACTURER'S DESIGNATION OF DRILL		
5. NAME OF DRILLER			13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED	UNDISTURBED
6. DIRECTION OF HOLE			14. TOTAL NUMBER CORE BOXES	6	
<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.			15. ELEVATION GROUND WATER		
7. THICKNESS OF OVERBURDEN		C.C.	16. DATE HOLE	STARTED	COMPLETED
8. DEPTH DRILLED INTO ROCK		92.2	17. ELEVATION TOP OF HOLE		
9. TOTAL DEPTH OF HOLE		92.2	18. TOTAL CORE RECOVERY FOR BORING	88 %	
			19. SIGNATURE OF INSPECTOR	JAMES E. BOLEN (SEE NOTES SHEET 6)	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			BROKEN GROUT - WEATHERED WHITE BRIGHT RUST		BOX 1	PULL 1
	1		VERY PALE GREEN			FROM C.C.
	2		CORE SPIN - BOTH BREAKS	85		TO 10.0
			WEATHERED WITH DARK BROWN METALLIC APPEARANCE			RUN 10.0
	3		HEALED FRACTURE VERY PALE GREEN BRIGHT YELLOW RUST			REC 8.5
			OLD BREAK SLICK FINISH - PALE GREEN			CL 1.5
	4		FG METALLIC			
			FB PALE GREEN CRYSTALS			
	5		OLD GROUT SOME CORE SPIN			
	6					
	7		FG SOME LARGE PALE BLUE QUARTZ CRYSTALS			
	8		FG PALE GREEN AND BLUE CRYSTALS			
	9					
	10			10.0		
	11		ALL APPEAR TO BE FRESH BREAKS	100		PULL 2
	12			12.0		FROM 10.0 CL 0.0
						TO 12.0
						RUN 2.0
						REC 2.0
	13		CONTINUED ON SHEET 2			PULL 3
				J-25		

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

Hole No. RE-4C

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 2

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	13				Box 1	Pull 3
	14		OLD FRACTURE A DRILLED GROUT HOLE			FROM 12.0 TO 22.0
	15		WHITE POWDERY	81		RUN 10.0
	16		WHITE		16.0	REC 8.1
	17		FB WHITE SNOWY APPEARANCE WHITE SNOWY FD DARK TO GRAYISH GREEN CORESPIN		Box 2	CL 1.9
	18					
	19					
	20		FB WITH PALE GREEN AND BLUE CRYSTALS			
	21					
	22		OLD HEALED FRACTURE WITH PYRITE AT CENTER WITH AXIS OF CORE FB PALE GREEN AND WHITE CRYSTALS	22.0		Pull 4
	23		DARK-SOOTY WITH LIGHT GRAY BRIGHT YELLOWISH-GREEN	93		FROM 22.0 TO 26.0
	24		YELLOWISH-GREEN & QUARTZ CRYSTALS			RUN 4.0
	25					REC 3.7
	26			26.0		CL 0.3
	27		DARK METALLIC WITH GREEN TINT PALE GREEN AND BLUE CRYSTALS FB	96		Pull 5
	28					FROM 26.0 TO 31.5
	29		Pull 5 HAS SEVERAL HEALED FRACTURES ALMOST PARALLELING CORE AXIS - FILLED WITH SOME GREENISH COLORED MATERIAL OR PYRITE CRYSTALS			RUN 5.5
	30		CONTINUED ON SHEET 3			REC 5.3
						CL 0.2

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. RE-40	
PROJECT			INSTALLATION		SHEET 3	
RICHARD B. RUSSELL DAM			CALHOUN FALLS, S.C.		OF 6 SHEETS	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	31		OLD BREAK DARK METALLIC WITH GREEN TINT		Box 2	PULL 5 (CONTINUED)
	32		OLD BREAK PYRITE PRESENT RED STREAK ACROSS CORE HAD CORE SPIN BUT APPEAR TO BE OLD JOINTS GREENISH-YELLOW	31.5	Box 3	PULL 6 FROM 31.5 TO 41.9 RUN 10.4 REC 8.6 CL 1.8
	33					
	34		GREENISH-YELLOW			
	35			83		
	36		LOW ANGLE HEALED FRACTURE FG			
	37		QUARTZ SEAM CALCITE FILLED			
	38					
	39		CALCITIC FB SMALL AMOUNT OF PALE YELLOW			
	40					
	41		HEAVY QUARTZ CONCENTRATION			
	42		FB	41.9		PULL 7 FROM 41.9 TO 51.6 RUN 9.7 REC 7.5 CL 2.2
	43		PALE GREEN FB			
	44		OLD QUARTZ FILLED FRACTURE	77		
	45					
	46		DARK METALLIC WITH PALE GREEN			
	47		CONTINUED ON SHEET 4	J-27		

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

Hole No. RE-40

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 4

OF 6 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV. ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	47.0		LOW ANGLE FRACTURES HIGH ANGLE FRACTURE (FILLED GROUT)		Box 4	PULL 7 (CONTINUED)
	48		RUSTY GROUT FILLED } BADLY WEATHERED AREA			
	49					
	50		OLD FRACTURES - LOOKS LIKE THIN GROUT			
	51					
	52		GROUT	51.6		PULL 8
	53					FROM 51.6 TO 58.9
	54		PALE YELLOWISH TINT LARGE AMOUNT OF QUARTZ CRYSTALS	89		RUN 7.3 REC 6.5 CL 0.8
	55		PALE GREEN METALLIC VUGS QUARTZ LINED			
	56		METALLIC WITH CORE SPIN			
	57					
	58		FB WITH PALE GREENISH TINT			
	59		GROUT? WITH RUST FB APPEARS WITH PALE GREENISH TINT	58.9		PULL 9
	60					FROM 58.9 TO 67.5
	61			94		RUN 8.6 REC 2.1 CL 0.5
	62		HEAVY CONCENTRATION OF QUARTZ		62.2 Box 5	
	63		FB PYRITE			
	64		PALE BLUE QUARTZ CRYSTALS			
	64		CONTINUED ON SHEET 5			

J-28

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

Hole No. RE-40

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 5

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	64.6				Box 5	PULL 9 (CONTINUED)
	65		CALCITIC OR GROUT			
	66		PALE GREEN CRYSTALS			
	67		DARK METALLIC OLD HEALED FRACTURES			
			QUARTZ CRYSTALS	67.5		
	68		GREENISH WITH QUARTZ AND GROUT - COULD BE FAULT ZONE			PULL 10 FROM 67.5 TO 77.4 RUN 9.9 REC 9.8 CL 0.1
	69		OLD FRACTURE - POSSIBILITY OF SOME GROUT			
	70		FD PALE YELLOWISH & BLUE CRYSTALS			
	71			99		
	72					
	73					
	74		AS ABOVE BREAK			
	75					
	76					
	77			77.4		
	78		GREENISH-YELLOW WITH GROUT PALE YELLOWISH-GREEN WITH QUARTZ HEALED FRACTURE		78.0 Box 6	PULL 11 FROM 77.4 TO 82.2 RUN 4.8 REC 4.0 CL 0.8
	79		GRAY	83		
	80		DARK METALLIC			
	81		CONTINUED ON SHEET 6	J-29		

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

Hole No. RE - 4c

PROJECT

PROJECT
RICHARD B. RUSSELL DAM

INSTALLATION

INSTALLATION
CATHOLIC FALLS, S.C.

SHEET /

1 OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	81		CORE SPIN			Pull 11 (CONTINUED)
	82		OLD HEALED FRACTURE - GREENISH GREENISH-YELLOW WITH PALE BLUE QUARTZ CRYSTALS	82.2		Pull 12
	83					FROM 82.2
	84		OB DARK METALLIC WITH PALE BLUE QUARTZ 1/2" QUARTZ FILLED FRACTURE			TO 92.2
	85					RW 10.0
	86		DARK METALLIC	94		REC 9.4
	87					CL 0.6
	88					
	89		OLD HEALED QUARTZ FILLED FRACTURES OB CORESPIN WITH REDDISH STREAKS QUARTZ FILLED FRACTURES			
	90					
	91					
	92		BOTTOM OF BORING 92.2'			
			NOTES: 1.) JAMES E. BOLEN DID NOT PHYSICALLY INSPECT THE CORE DEPICTED ON THIS LOG. AN ATTEMPT WAS MADE ON HIS BEHALF TO RE- PRODUCE AN EARLIER COPY OF THIS LOG INTO A FORM MORE FREQUENTLY USED BY THE SAVANNAH DISTRICT. THIS DOCUMENT REPRESENTS THAT ATTEMPT. 2.) A GRAPHIC LEGEND WAS USED IN LIEU OF THE STANDARD "ROCK" LEGEND PRESUMABLY FOR THE PURPOSE OF ILLUSTRATING JOINTS AND OTHER ROCK DISCONTINUITIES. 3.) THE AUTHOR OF THE ORIGINAL LOG WAS NOT RECORDED AND IS AT THIS WRITING (JAN 1987) UNKNOWN.			

DRILLING LOG		DIVISION SOUTH ATLANTIC	INSTALLATION CALHOUN FALLS, S.C.	SHEET 1 OF 6 SHEETS
1. PROJECT R. B. RUSSELL DAM		10. SIZE AND TYPE OF BIT NX		
2. LOCATION (Coordinates or Station) 44+11 STA. ON S.C. EARTH EMBANKMENT		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL		
3. DRILLING AGENCY SAVANNAH DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL SMCO		
4. HOLE NO. (As shown on drawing title and file number) RE-42		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED _____ UNDISTURBED _____		
5. NAME OF DRILLER WILLIAM HILL (OF BOYLES BROS.)		14. TOTAL NUMBER CORE BOXES		
6. DIRECTION OF HOLE <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/> INCLINED 20° DEG. FROM VERT.		15. ELEVATION GROUND WATER		
7. THICKNESS OF OVERBURDEN C.C.		16. DATE HOLE STARTED 26 JAN 1981 COMPLETED 28 JAN 81		
8. DEPTH DRILLED INTO ROCK 29.9		17. ELEVATION TOP OF HOLE 408.1 SST.		
9. TOTAL DEPTH OF HOLE 29.9		18. TOTAL CORE RECOVERY FOR BORING NA		
		19. SIGNATURE OF INSPECTOR JAMES F. BOLEN (SEE NOTES - SHEET 6)		

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		FRESH BREAKS POSSIBLY ALONG OLD HEALED FRACTURES			Pull 1
	1		BREAK ALONG HEALED FRACTURES CALCITIC FILL			
	2					
	3		FRACTURES FILLED WITH A MILKY WHITE TO LIGHT GRAY			
	4		LIGHT TAN TO YELLOW			
	5		WEATHERED LOOK WITH CORROSION MAYBE SOME CLAY FILL SMALL ROCK FRAGMENTS LOOKS LIKE CALCITIC FILLED FRACTURE YELLOWISH-GREEN STREAK ALMOST WITH LONG AXIS OF CORE			Pull 2
	6		FB			
	7		FB			
	8		FG FB ALMOST QUARTZ ZONE			
	9		FB			Pull 3
	10		FG FB FB			
	11		SEAM OF QUARTZ			
	12		FB			
	13		CONTINUED ON SHEET 2			Pull 4

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

408.5

Hole No. RE - 42

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 2

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	13		FB			Pull 4 (CONTINUED)
	14		FB			
	15		FB SOME DISCOLORATION FROM BEING DROPPED FROM CORE BARREL			
	16		BROKE THROUGH QUARTZ SEAM			
	17		FB			Pull 5
	18		17.6-17.7 DARK METALLIC WITH SHINY FLAKES			
	19		FB CORE SPIN			
	20		FB			
	21		FB			Pull 6
	22		BRIGHT RUSTY COLORING			
	23		FB			
	24		FB			
	25		FB			
	26		FB			Pull 7
	27		FB			
	28					
	29					
	30		CONTINUED ON SHEET 3			

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 408 ±	Hole No. RE - 42		
PROJECT RICHARD B. RUSSELL DAM			INSTALLATION CALHOUN FALLS S.C.		SHEET 3 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		FB			Pull 7 (CONTINUED)
	31		BREAK ALONG THIN QUARTZ SEAM 0.05'			Pull 8
	32		BREAK ALONG 0.15' QUARTZ SEAM			
	33		FB			Pull 9
	34		FRAGMENT LOOKS LIKE THIN QUARTZ SEAMS THAT THE DRILL BROKE UP THIN QUARTZ SEAMS FG HEALED FRACTURES @ 60° TO AXIS OF CORE			
	35		FB FG FB			Pull 10
	36					
	37		FB			Pull 11
	38		FB SOME QUARTZ			
	39		FB			
	40		QUARTZ SEAM			Pull 12
	41		ONE LARGE HEALED FRACTURE RUNNING ALMOST WITH THE AXIS OF THE CORE FB			
	42		FB			
	43					
	44		FB			Pull 13
	45		FB			
	46		FB FB			
	47		CONTINUED ON SHEET 4			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

408.2

Hole No. RE-42

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 4

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	47					Pull 14
	48					
	49					
	50					Pull 15
	51		FB FINER GRAIN MATERIAL STILL SAME COLOR			
	52		FB THIN QUARTZ SEAM			
	53					
	54		FB? CORE SPIN			
	55		FB			Pull 16
	56		HEALED FRACTURES } FINER FB GRAINED MATERIAL			
	57		FB			
	58		FB			Pull 17
	59		FB			
	60		PALE POSSIBILITY CALCITIC MATERIAL			
	61		BLACK METALLIC MATERIAL			
	62		GREENISH - YELLOW WITH MICA FLAKES			
	63		FB			Pull 18
	64		CONTINUED ON SHEET 5			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

408±

Hole No. RE-42

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 5

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81			Continued on Sheet 6			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE

402 ±

Hole No. RE-42

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 6

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
82						
83						
84						
85						
86						
87			FILLED WITH LIGHT TAN MATERIAL			
88			FB SEVERAL OLD HEALED FRACTURES IN THIS LAST 2 FEET			
89			APPEARS FRESH BUT IN SAME DIRECTION AS ABOVE AND IN OTHER RUNS			
			FB MORE HEALED FRACTURES AT APPROX 30° TO CORE			PUL 26
			BOTTOM OF BORING 89.9 TO 89.9			
<p>NOTES:</p> <p>1.) JAMES E. BOLEN DID NOT PHYSICALLY INSPECT THE CORE DEPICTED ON THIS LOG. AN ATTEMPT WAS MADE ON HIS BEHALF TO REPRODUCE AN EARLIER COPY OF THIS LOG INTO A FORM MORE FREQUENTLY USED BY THE SAVANNAH DISTRICT. THIS DOCUMENT REPRESENTS THAT ATTEMPT.</p> <p>2.) A GRAPHIC LEGEND WAS USED IN LIEU OF THE STANDARD "ROCK" LEGEND PRESUMABLY FOR THE PURPOSE OF ILLUSTRATING JOINTS AND OTHER ROCK DISCONTINUITIES.</p> <p>3.) THE AUTHOR OF THE ORIGINAL LOG WAS NOT RECORDED AND IS AT THIS WRITING (JAN 1987) UNKNOWN.</p>						

DRILLING LOG		DIVISION SCOUT ATLANTIC	INSTALLATION CANTON FALLS, S.C.	SHEET 1 OF 6 SHEETS
1. PROJECT RICHARD B. RUSSELL DAM			10. SIZE AND TYPE OF BIT NX	
2. LOCATION (Coordinates or Station) Sta 44+74 S.C. EMBANKMENT			11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY SAVANNAH DISTRICT			12. MANUFACTURER'S DESIGNATION OF DRILL SIMCO	
4. HOLE NO. (As shown on drawing title and file number) RE-43			13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	
5. NAME OF DRILLER WILLIAM HILL & KEVIN POWER (BOYES Bros)			14. TOTAL NUMBER CORE BOXES 6	
6. DIRECTION OF HOLE <input type="checkbox"/> VERTICAL <input checked="" type="checkbox"/> INCLINED 20° DEG. FROM VERT.			15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN 0.3			16. DATE HOLE STARTED 19 JAN 1981 COMPLETED 21 JAN 1981	
8. DEPTH DRILLED INTO ROCK 91.2			17. ELEVATION TOP OF HOLE 425 F	
9. TOTAL DEPTH OF HOLE 91.5			18. TOTAL CORE RECOVERY FOR BORING NA	
			19. SIGNATURE OF INSPECTOR JAMES E. BOLEN (SEE NOTES SHEET 1)	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	1		HIGHLY WEATHERED AND FRACTURED BROKEN SURFACES COATED WITH RED CLAY		Box 1	Pull 1
	2		APPROX. 2.0' TO 2.5' LIGHT AND LOOSE			
	3					
	4					
	5		HIGHLY WEATHERED - FRACTURED BROKEN SURFACES COATED WITH CLAY			Pull 2
	6		APPROX 2.0 FEET (LOOSE)			
	7					
	8		CONTACT BREAKS COATED WITH PALE GREENISH - WHITE MATERIAL			Pull 3
	9					
	10		CORE LOSS IN THIS AREA			
	11					
	12		BREAKS IN THIS 1.5' LENGTH ARE COATED WITH A RUSTY BROWN COLOR			
	13		CONTACT CONTINUED ON SHEET 2			Pull 4

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 425 ±		Hole No. RE-43	
PROJECT RICHARD B. RUSSELL DAM			INSTALLATION CALHOUN FALLS, S.C.		SHEET 2 OF 6 SHEETS	
ELEVATION a	DEPTH 13 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
					Box 1	Pull 4 (CONTINUED)
	14		ALL BREAKS IN RUN 4 ARE IN THE GENERAL DIRECTION APPROX. 0.05' DIP IN CORE WIDTH. ALL ARE COATED WITH DULL RUSTY TO A BRIGHT YELLOWISH RUSTY COLOR - EVEN THE HIGH ANGLE AT TOP OF RUN			
	15					
	16					
	17					
					Box 2	
	18		THESE BREAKS IN SAME DIRECTION COATED WITH LIGHT GRAY-WHITE MATERIAL			Pull 5
	19		CLAY FILLED JOINT (ALL BREAKS SEEM TO DIP IN THE SAME DIRECTION)			Pull 6
	20		LIGHT GRAY MATERIAL			
	21		CLAY FILLED JOINT			
			RUSTY COLORED			
	22		LIGHT GRAY-GREENISH			
			FB			
	23		BREAKS FILLED WITH LIGHT GRAY MATERIAL			Pull 7
	24					
	25		GREENISH-YELLOW MATERIAL CONTACT			Pull 8
	26		GRAY-WHITE (GREAT NUMBER OF HEALED FRACTURES GRAY-WHITE)			
	27		GRAY-WHITE			
	28		BRIGHT YELLOWISH GREEN			
			BRIGHT RUSTY YELLOWISH-WHITE (POSSIBLE FAULT ZONE)			
	29		RUSTY COLOR			Pull 9
			HIGHLY FRACTURED ZONE MOSTLY HEALED FRACTURES			
	30		CONTINUED ON SHEET 3			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 425 ±		Hole No. RE-43		
PROJECT RICHARD B. RUSSELL DAM		INSTALLATION CALHOUN FALLS, S.C.		SHEET 3 OF 6 SHEETS		
ELEVATION a	DEPTH 30 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			FRACTURES		Box 2	Pull 9 (CONTINUED)
	31		CONTACT			
	32		FB YELLOW MATERIAL		Box 3	
	33		RUSTY TO PALE GREENISH-YELLOW POSSIBLE FAULT OR SMALL DIKE			Pull 10
	34		RUSTY YELLOW LONG FRACTURE FILLED WITH BLACK SOOTY MATERIAL			
	35		YELLOW RUSTY BROWN FROM POSSIBLY FAULT OR DIKE TO END OF RUN			
	36		SEVERAL OLD HEALED FRACTURES			
	37		WHITE MATERIAL CORE SPIN			Pull 11
	38					
	39		PALE GREENISH WHITE RUSTY COLORING			
	40					
	41		GREENISH RUSTY - DARK SOOTY GREYISH			
	42		YELLOWISH-WHITE			Pull 12
	43		FB CORE SPIN			
	44		FB GREENISH-WHITE			
	45		FG LIGHT GRAY			
	46		WHITE GRAY GREENISH-WHITE		Box 3 Box 4	Pull 13
	47		CONTINUED ON SHEET 4			

J-39

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 425 ±		Hole No. RE-43		
PROJECT RICHARD B. RUSSELL DAM		INSTALLATION CARLOW FALLS, S.C.		SHEET 4 OF 6 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	47		LIGHT COLOR CORE SPIN		Box 4	Pull 13 (CONTINUED)
	48		FG			Pull 14
	49		WHITE CALCITIC			
	50		FB WHITE CALCITIC			
	51					
	52		FB			Pull 15
	53		FB FG			
	54		FB FB CORE SPIN			
	55		VERY PALE YELLOW			DIPPING IN SAME DIRECTION AND ANGLE
	56		FB			Pull 16
	57		FB			
	58		PALE WHITE MATERIAL			
	59		FB			
	60		FB			
	61		FG			
	62		FB		Box 4 Box 5	Pull 17
	63		FB			
	64		BREAKS IN THIS SYSTEM ALL COATED WITH WHITE TO DARK GRAY MATERIAL CONTINUED ON SHEET 5			

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE 425 ±		Hole No. RE-43		
PROJECT RICHARD B. RUSSELL DAM			INSTALLATION CALHOUN FALLS S.C.			SHEET 5 OF 6 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	64		FB		Box 5	Pull 17 (CONTINUED)	
	65		FB				
			FB				
	66		FB				
			FB			Pull 18	
	67						
	68		OLD WHITE FILLED FRACTURE				
			FB				
	69						
	70		WHITE COATING			Pull 19	
			DARK GRAY METALLIC MATERIAL				
	71						
			CORE SPIN				
	72		FB				
			FB NEAR OLD HEALED FRACTURE				
	73		WHITE CALCITIC MATERIAL				
	74						
			WHITE MATERIAL			Pull 20	
	75		WHITE COATING				
			WHITE COATING				
	76		WHITE COATING				
			FB		Box 5		
			WHITE COATING WITH CORE SPIN		Box 6		
	77		CONTACT				
			WHITE COATING				
			WHITE COATING				
	78		WHITE				
			FB				
	79						
			BROKEN UP ALONG OLD FRACTURES AND CONTACT LINE				
	80		WHITE COATING ON CONTACT			Pull 21	
			BREAKS APPEAR FRESH BUT SLIGHT ORIENTATION AND SLIGHT DIP - POSSIBLE OLD FRACTURES				
	81		CONTINUED ON SHEET 6				

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE
425±

Hole No. RE-43

PROJECT

RICHARD B. RUSSELL DAM

INSTALLATION

CALHOUN FALLS, S.C.

SHEET 6

OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	81		WHITE COATING		Box 6	Pull 21
	82		FB			Pull 22
	83		LIGHT WHITE COATING CORE SPIN			
	84		CONTACT FB FB			
	85		WHITE COATING CONTACT			
	86		APPEARS FRESH BUT PALE GREEN CORESPIN COATING PALE YELLOW COATING			
	87		FB PALE YELLOW PALE YELLOW			Pull 23
	88		FB			
	89		PALE YELLOW WHITE COATING FB WHITE COATING			
	90		FB FB WHITE COATING			
	91					
			BOTTOM OF BORING 91.5'	91.5	TD	
<p>NOTES:</p> <p>1.) JAMES E. BOWEN DID NOT PHYSICALLY INSPECT THE CORE DEPICTED ON THIS LOG. THIS DOCUMENT REPRESENTS AN ATTEMPT TO REPRODUCE AN EARLIER LOG INTO A FORM MORE GENERALLY USED BY THE SAVANNAH DISTRICT.</p> <p>2.) A GRAPHIC TYPE LEGEND WAS USED IN LIEU OF THE MORE FREQUENTLY USED "ROCK" STYLE LEGEND - PRESUMABLY FOR THE PURPOSE OF ILLUSTRATING JOINTS AND OTHER DISCONTINUITIES IN THE CORE.</p> <p>3.) THE AUTHOR OF THE ORIGINAL LOG IS AT THIS WRITING (JAN. 1987) UNKNOWN.</p>						

APPENDIX K

RICHARD B. RUSSELL PROJECT PHOTOS

APPENDIX K

RICHARD B. RUSSELL PROJECT PHOTOS

<u>Photograph</u>	<u>Description</u>	<u>Page</u>
Diversion Channel:		
1	Looking downstream thru diversion channel showing sedimentation pond and Clark Hill reservoir.	K-13
2	Looking upstream at diversion channel.	K-13
3	Dravo crane crossing service bridge of diversion channel.	K-14
4	Looking east across diversion channel, along axis of dam.	K-14
5	Diversion channel excavation after second stage diversion - viewing southeast from west bank of Georgia cutoff trench.	K-15
6	Diversion channel excavation after second stage diversion - viewing south.	K-15
7	Diversion channel excavation after second stage diversion - viewing west. Note downstream slope of cutoff trench being dressed by Groves.	K-17
Cofferdike:		
8	General view of cofferdike looking west.	K-18
9	Cofferdike - slurry trench, looking west showing fracture leading into trench.	K-18
10	Cofferdike - slurry trench excavation.	K-19
Excavation and Blasting:		
11	Detonation of Blast Pattern 1001, South Carolina abutment.	K-21
12	Blast Pattern 1007 after blast, looking west.	K-21

RICHARD B. RUSSELL PROJECT PHOTOS

<u>Photograph</u>	<u>Description</u>	<u>Page</u>
13	View from near South Carolina tailrace wall. Blast Pattern 1242 Monoliths 13 and 14 about 360' right of centerline.	K-22
14	Blast No. 112, Georgia abutment .	K-22
15	Tailrace Class I excavation standing at station 30 + 00 looking east.	K-23
16	Blast Pattern 1021 detonation - South Carolina abutment.	K-23
17	Mod "G" - standing 800' downstream of station 27 + 00, looking northeast.	K-24
18	Mod "G" - standing 800' downstream of station 27 + 00, looking north.	K-24
19	Looking west into west retaining wall foundation area - near horizontal wall seam is at El. 307.	K-25
20	Standing in Monolith 16, looking west during excavation.	K-25
21	Clean-up in Monolith 30 after blasting, looking west.	K-26
22	Lane drillers on production shot downstream of draft tubes. Foreman (Frank Poes) reported difficulty with seam at about elevation 258'.	K-26
23	Georgia abutment - Dravo cleanup crew in foreground, Lane crew in background.	K-27
Concrete Dam General:		
24	Early dam construction - mod "L".	K-29
25	Preparing to place concrete on monolith surfaces.	K-29
26	First bucket of concrete - Monolith 2 .	K-30

RICHARD B. RUSSEL PROJECT PHOTOS

<u>Photograph</u>	<u>Description</u>	<u>Page</u>
27	Construction in Blocks 19 and 18. Note excavated South Carolina abutment in background.	K-30
28	View of excavated Monoliths 27, 26 and 25 from the upstream side of Monolith 30. Note EHG dikes and faulting, and trestle construction top center.	K-31
29	Excavation in the service bay area.	K-31
30	View looking west from South Carolina embankment Block 32.	K-32
31	Monolith construction - view from upstream South Carolina abutment non-overflow block in foreground.	K-33
32	Spilway training wall - note South Carolina non-overflow Monolith 26 and 27, right side of photo.	K-34
33	Installation of plumb bob pipe, Block 26.	K-34
34	Sumps - Monolith 16.	K-35
35	Leak in dewatering pipe - Monolith 25.	K-36
36	Uplift cell installation, Block 7.	K-36
37	Uplift cell installation, Block 7.	K-37
38	Uplift cell read-out box, Block 7 - note gallery framework.	K-37
39	Finalizing uplift cell installation, Block 7	K-38
40	Uplift cell installation, Block 10 - note future read-out box, center.	K-38
41	Forming inspection gallery for Monolith 27. Note uplift cells in Block 28, upper right.	K-39
42	Downstream side of dam after second stage stage diversion.	K-39

RICHARD B. RUSSELL PROJECT PHOTOS

<u>Photograph</u>	<u>Description</u>	<u>Page</u>
43	Downstream side of dam after second stage diversion	K-40
44	Downstream side of dam after second stage diversion.	K-40
45	Downstream side of dam shortly after second stage diversion.	K-41
46	Upstream side of dam.	K-41
47	Upstream side of dam - Sluice entrances with stop log.	K-42

Concrete Dam Foundation:

48	Monolith 1 foundation.	K-44
49	Monolith 2 foundation - dike running downstream under trestle toward upstream of Monolith 2.	K-45
50	Monolith 2 foundation, stress zone.	K-45
51	Monolith 3 foundation.	K-46
52	Monolith 3 foundation.	K-46
53	Upstream third of Monolith 5 foundation, taken from trestle.	K-47
54	Monolith 5 foundation.	K-47
55	Monolith 6 foundation.	K-48
56	Monolith 6 foundation.	K-48
57	Monolith 7 foundation.	K-49
58	Monolith 7 foundation.	K-50
59	Monolith 7 and 8 step-up face.	K-51
60	Monolith 7 and 8 step-up face.	K-52
61	Monolith 8 foundation.	K-53

RICHARD B. RUSSELL PROJECT PHOTOS

<u>Photograph</u>	<u>Description</u>	<u>Page</u>
62	Monolith 8 foundation.	K-54
63	Monolith 10 foundation.	K-54
64	Monolith 10 foundation.	K-55
65	Monolith 11 foundation viewing toward Georgia side, downstream corner.	K-55
66	Monolith 11 foundation.	K-56
67	Monolith 12 foundation, viewing upstream.	K-56
68	Monolith 12 foundation.	K-57
69	Monolith 13 foundation.	K-57
70	Monolith 13 foundation, fault is present near middle of photo.	K-58
71	Monolith 14 foundation - fault.	K-58
72	Monolith 14 foundation, South Carolina side of penstock.	K-59
73	Monolith 15 foundation.	K-60
74	Monolith 15 foundation.	K-60
75	Monolith 16 foundation.	K-61
76	Monolith 16 foundation.	K-61
77	Monolith 19 foundation.	K-62
78	Monolith 19 foundation.	K-62
79	Monolith 20 foundation.	K-63
80	Monoliths 20, 21, 22 area - Water Blaster.	K-63
81	Monolith 21 foundation, possible fault action.	K-64
82	Monolith 22 foundation.	K-64

RICHARD B. RUSSELL PROJECT PHOTOS

<u>Photograph</u>	<u>Description</u>	<u>Page</u>
83	Monolith 22 foundation.	K-65
84	Monolith 23 foundation, grouting	K-65
85	Monolith 23 foundation.	K-66
86	Monolith 25 foundation.	K-66
87	Monolith 26 foundation.	K-67
88	Monolith 26 - Installation of rebar basket on footer foundation.	K-67
89	Monolith 27 foundation.	K-68
90	Monolith 27 foundation.	K-68
91	Monolith 28 foundation.	K-69
92	Monoliths 28/29 step-up face.	K-69
93	Monoliths 28/29 step-up face.	K-70
94	Monolith 29 foundation.	K-70
95	Monolith 30 foundation - downstream Georgia corner.	K-71
96	Monolith 30 foundation.	K-71
97	Monolith 31 foundation.	K-72
98	Monolith 32 foundation - looking upstream.	K-72
99	Monolith 32 foundation - looking east.	K-73

Grouting Inside Gallery:

100	Gallery grouting - Block 22, CP-65 drill at work.	K-75
101	Chicago pneumatic CP-65 drilling grout hole.	K-75
102	Uplift cell read-out boxes, Block 23.	K-76
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118	Tailrace area excavation.	K-87
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124	Powerhouse "noses".	K-90
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160	Georgia east embankment clean-up. Note quarry operation in background.	K-113
161	Station 24 + 00 looking south across Monolith 1 layout.	K-113
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163	Georgia abutment after second clean-up. Note four trestle footers at right.	K-114
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DIVERSION CHANNEL PHOTOS



Photo 1 - Looking downstream thru diversion channel showing
sedimentation pond and Clark Hill Reservoir (March 1978)



Photo 2 - Looking upstream at diversion channel
(March 1978)

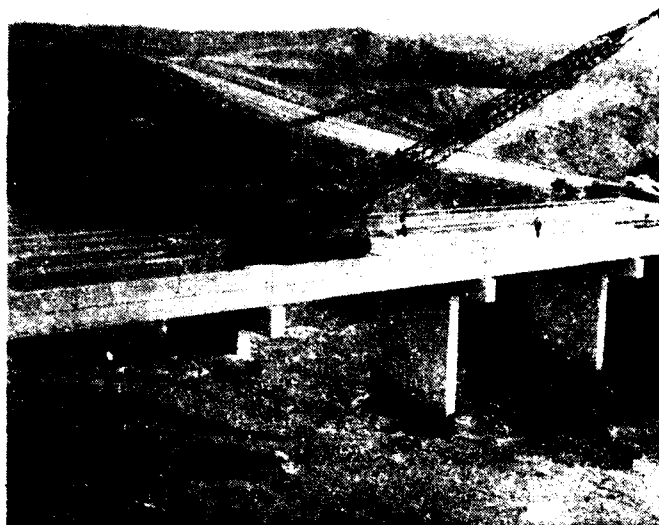


Photo 3 - Dravo crane crossing service bridge of diversion channel (July 1978)



Photo 4 - Looking east across diversion channel, along axis of dam (March 1978)



Chart 5 - diversion channel excavation after second stage diversion, viewing south. (March 1982)



Chart 6 - diversion channel excavation after second stage diversion, viewing south. (March 1982)



Photo 7 - diversion channel excavation after second stage diversion, viewing west. Note down stream slope of outlet trench has been dressed by dozer. (March 1982)

COFFERDIKE PHOTOS



Photo 8 - General view of cofferdike looking west
(October 1977)



Photo 9 - Cofferdike - slurry trench, looking west
showing fracture leading into trench
(November 1977)

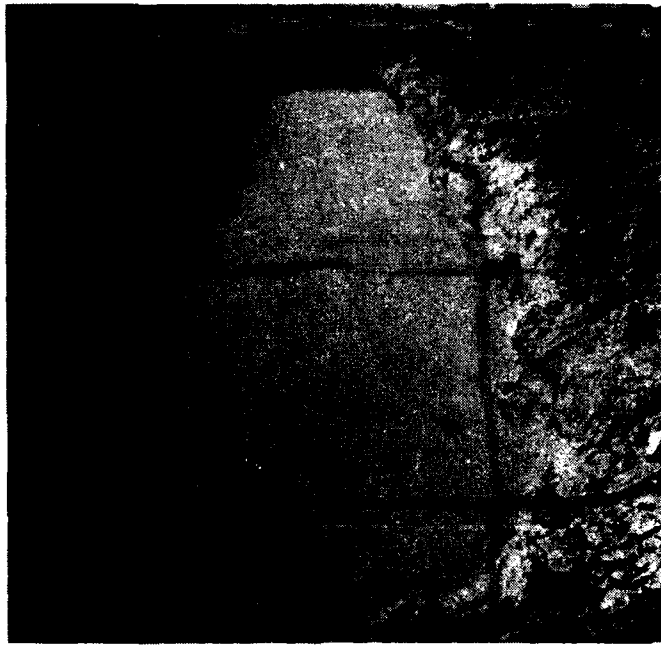


Photo 10 - Cofferdike - slurry trench excavation (October 1977)

EXCAVATION AND BLASTING PHOTOS

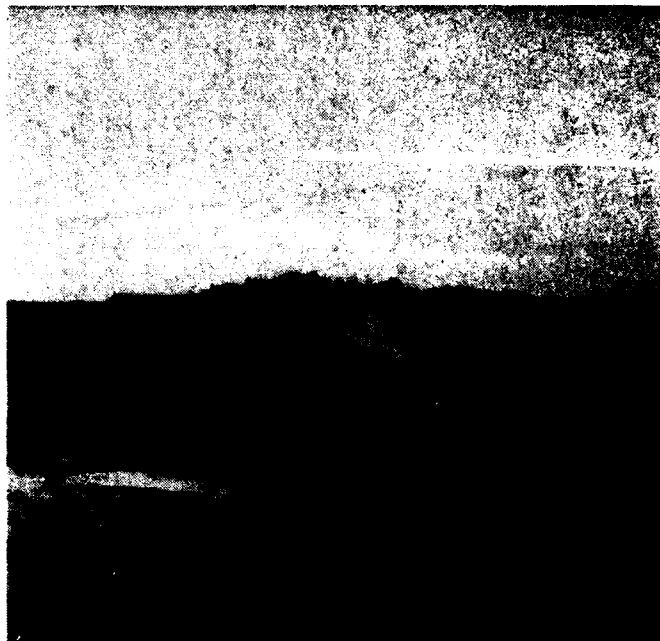


Photo 11 - Detonation of Blast Pattern 1001,
South Carolina abutment (January 1978)



Photo 12 - Blast Pattern 1007 after blast, looking
west (March 1978)

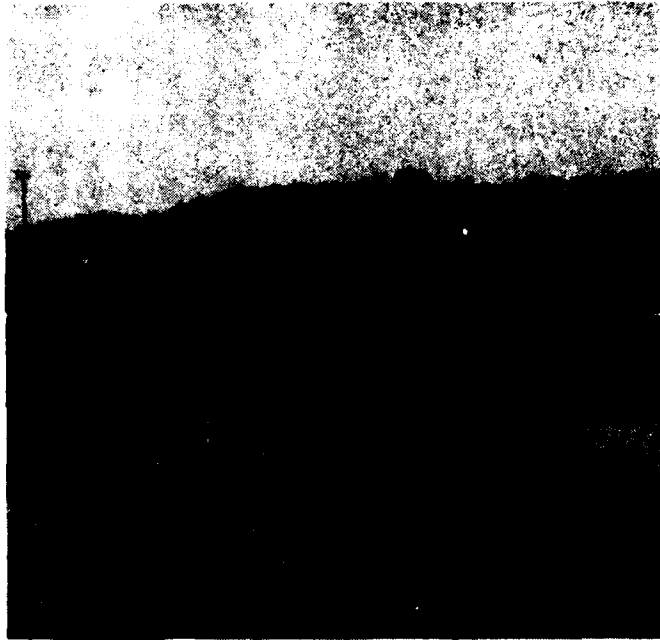


Photo 13 - View from near South Carolina tailrace wall. Blast Pattern 1242, Monoliths 13 and 14 about 360' right of centerline (June 1978)

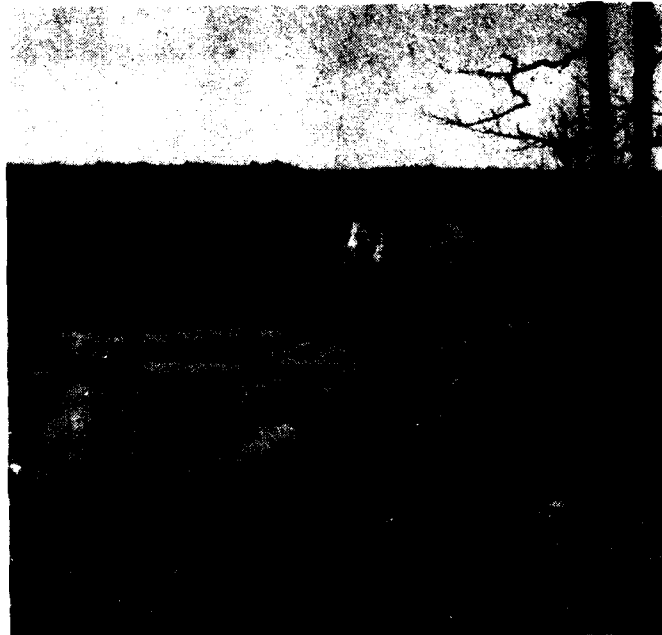


Photo 14 - Blast No. 112, Georgia abutment (March 1978)



Photo 15 - Tailrace Class 1 excavation standing at
station 30 + 00 looking east (April 1978)



Photo 16 - Blast Pattern 1021 detonation - South Carolina
abutment (April 1978)



Photo 17 - Mod "G" - Standing 800' downstream of
Station 27 + 00, looking northeast
(July 1978)



Photo 18 - Mod. "G" - standing 800' downstream of
Station 27 + 00, looking north (July 1978)



Photo 19 - Looking west into west retaining wall foundation area - near horizontal wall seam is at El. 307 (September 1978)



Photo 20 - Standing in Monolith 16, looking west during excavation (September 1978)



Photo 21 - Clean-up in Monolith 30 after blasting,
looking west (September 1978)



Photo 22 - Lane drillers on production shot downstream
of draft tubes. Foreman (Frank Poes) reported
difficulty with seam at about elevation 258'
(October 1978)

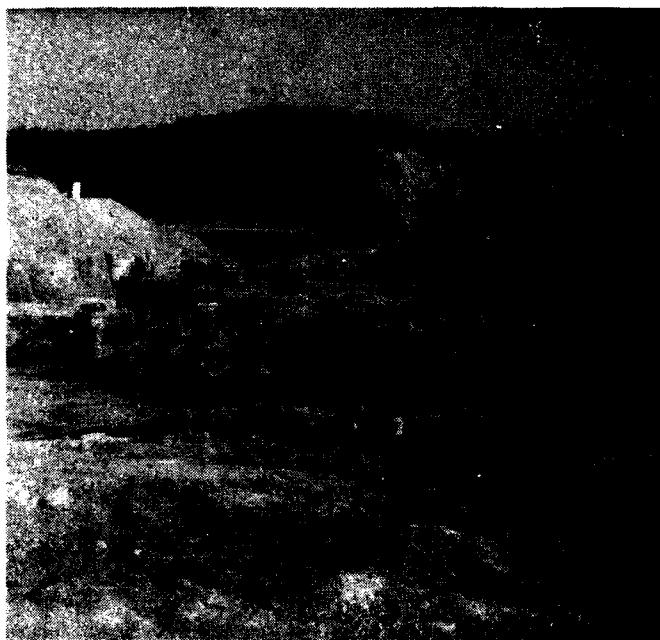


Photo 23 - Georgia abutment - Dravo cleanup crew in foreground,
Lane crew in background (October 1978)

CONCRETE DAM GENERAL PHOTOS

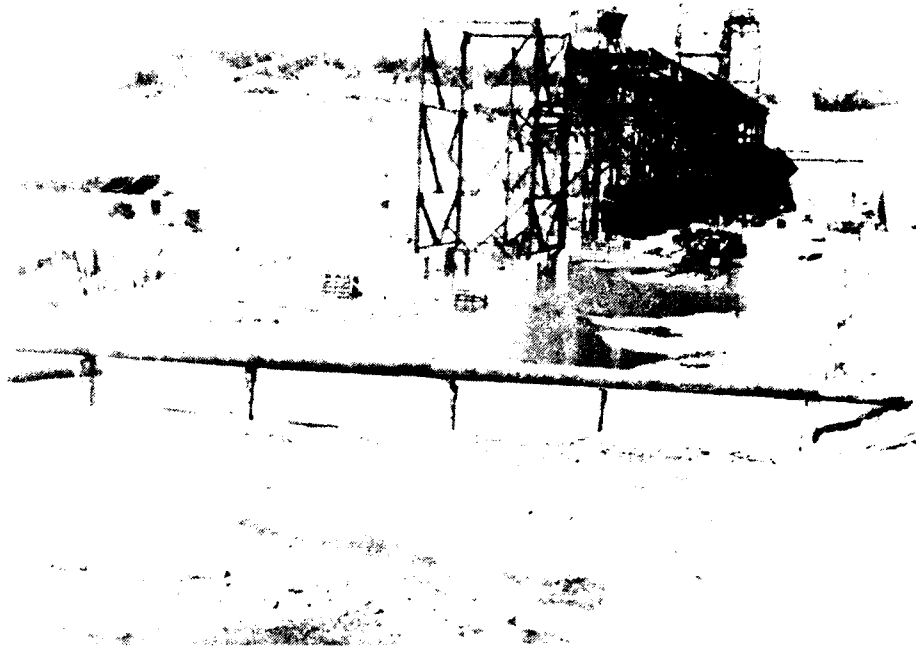


Photo 24 - Early dam construction - mod "L". Pipe in foreground carried upstream surface water to the dewatering area downstream. (May 1979)

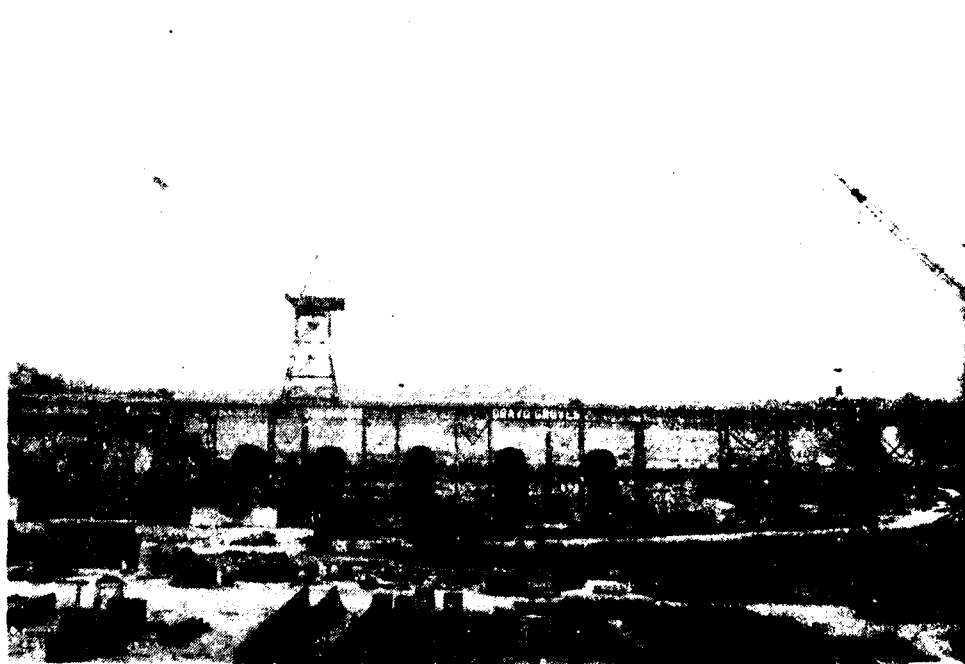


Photo 25 - Preparing to place concrete on monolith surfaces.

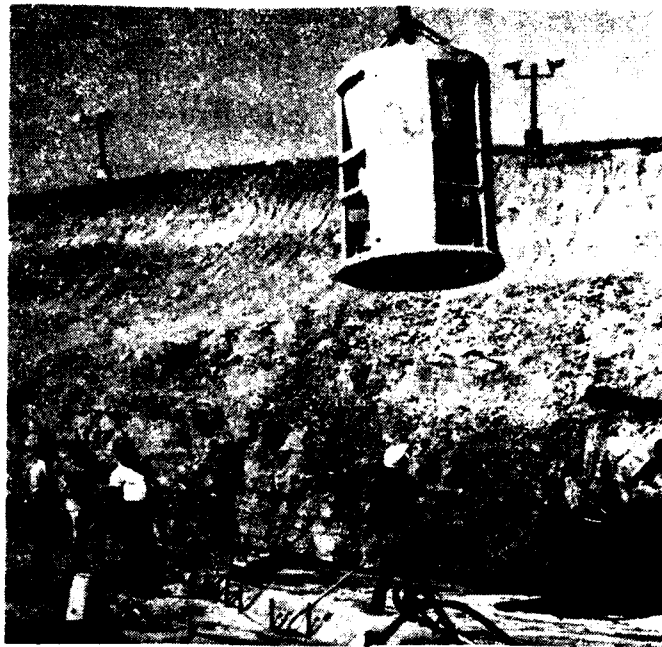


Photo 26 - First bucket of concrete - Monolith 2



Photo 27 - Concrete structure under construction - Monolith 2

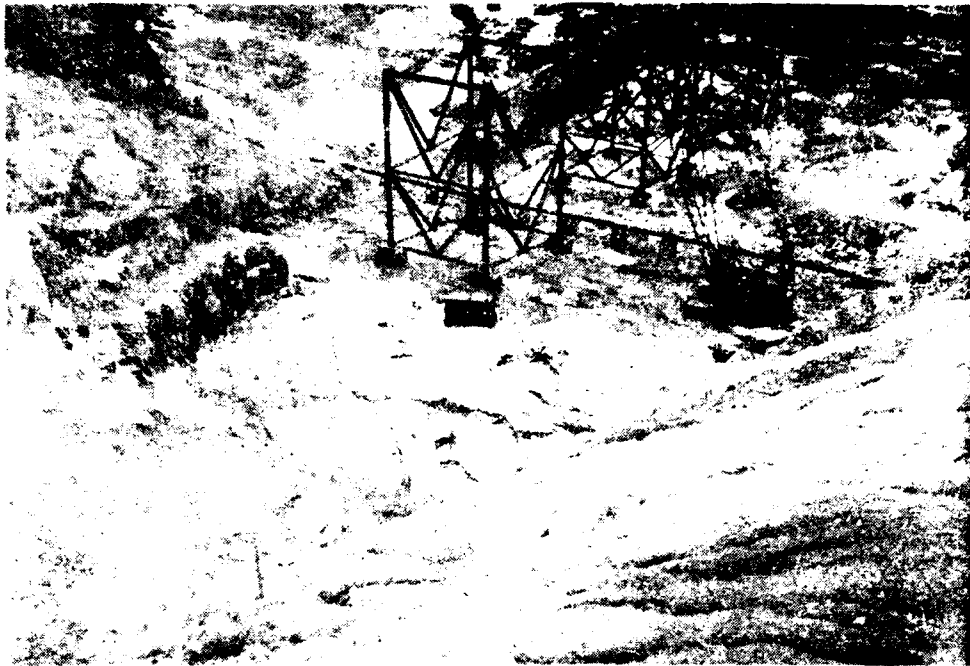


Plate 28 - View of excavated Monoliths 27, 26, and 25 from the upstream side of Monolith 30. Note EHC dikes and faulting, and trestle construction, top center (August 1979)

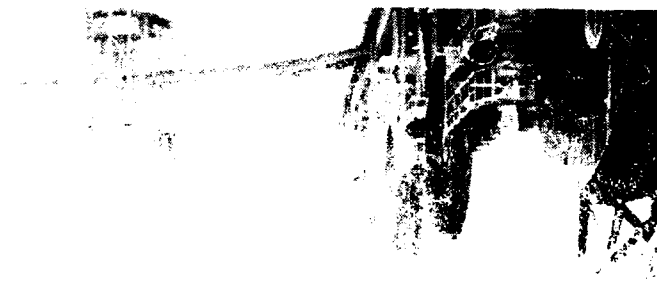




Photo 30 - View looking west from South Carolina embankment Block 32

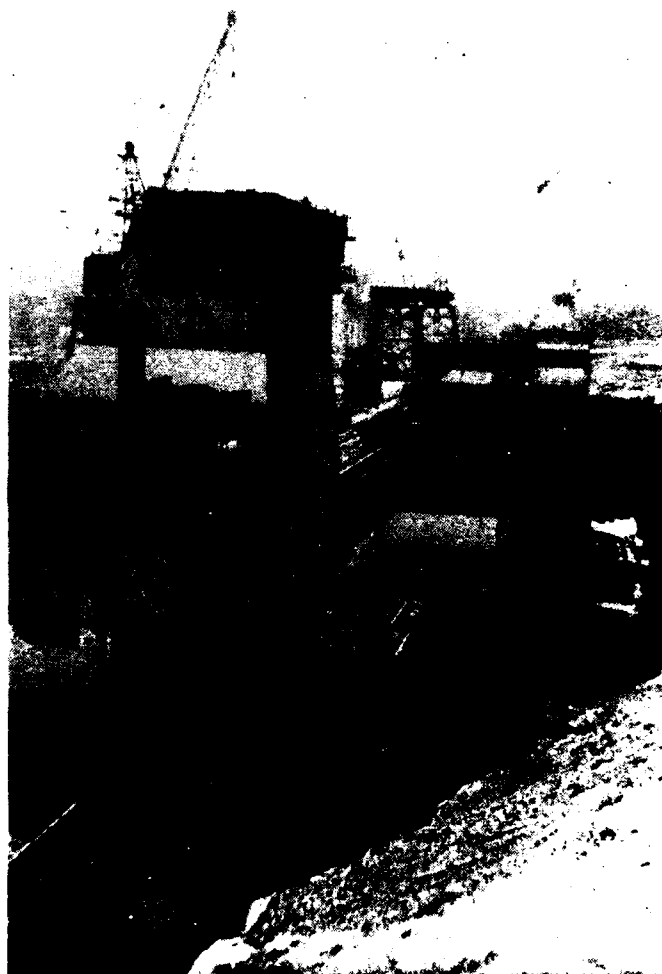


Photo 31 - Monolith construction - view from upstream
South Carolina abutment - non-overflow block
in foreground (October 1980)



Photo 32 - Spillway training wall - note North Carolina non-overflow Monoliths 26 and 27, right side of photo.

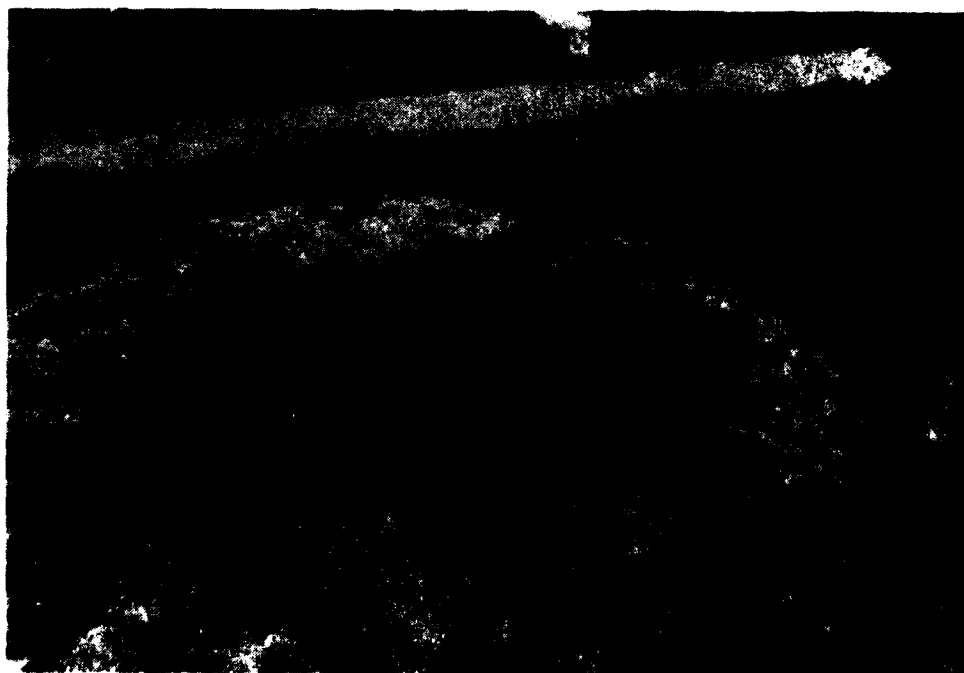


Photo 33 - Installation of plumb bob pipe, Block 26 (December 1979)



Photo 34 - Sumps - Monolith 16 (September 1979)

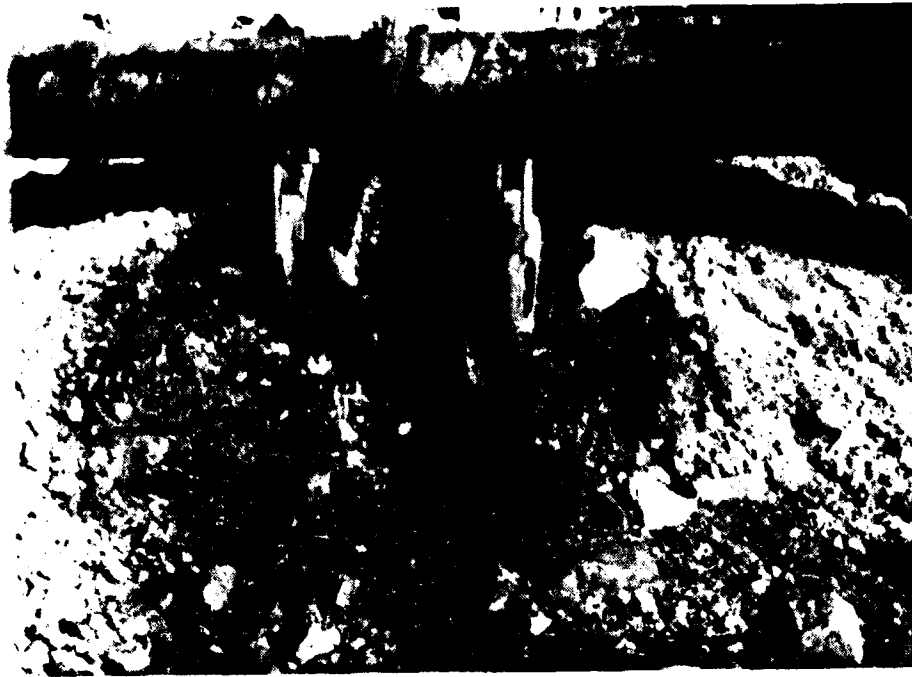


Photo 3 - Leak in rawwatering pipe - Monolith 1. (November 1979)

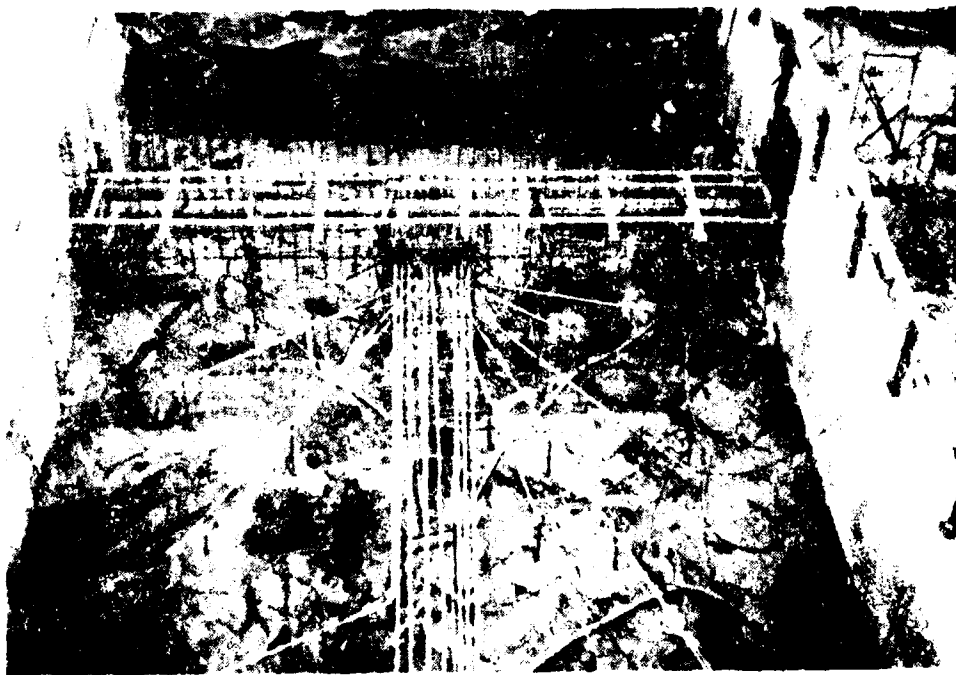


Photo 4 - Filter Cell Installation, Block 7 (January 1980)

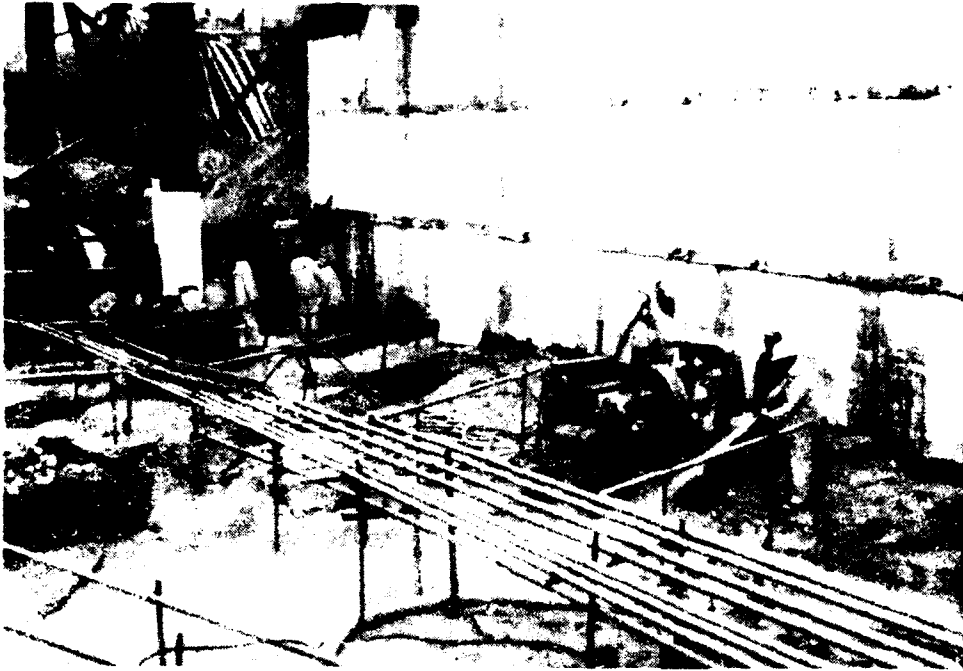


Fig. 17 - "pilot cell" installation, Block 7, January 1980

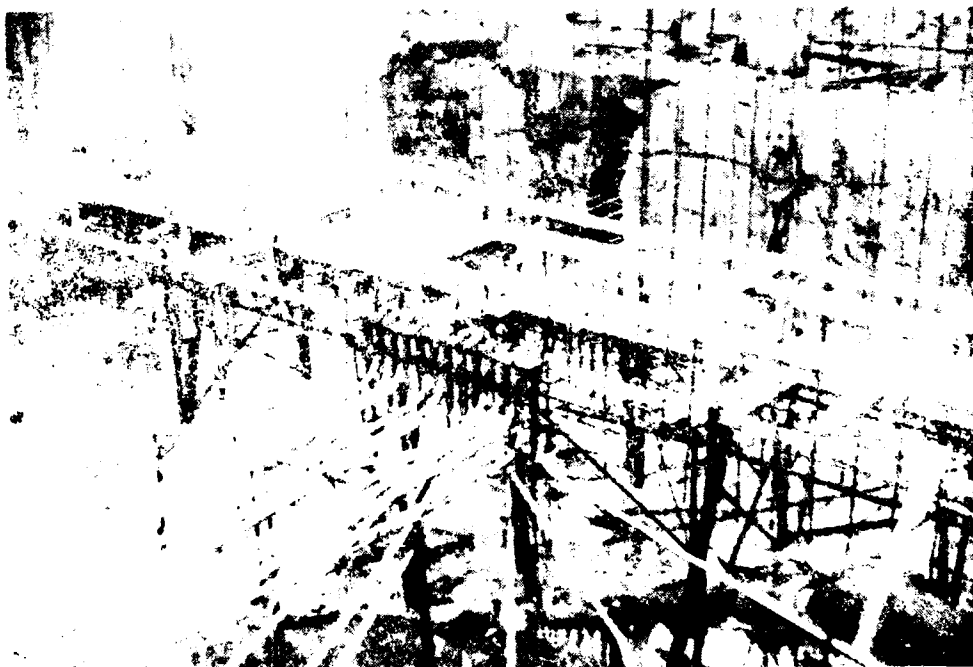


Fig. 18 - "pilot cell" installation, Block 7, January 1980. The network of pipes on the right, running parallel to the far axis are about 10' x 10' x 10' in size. (January 1980)

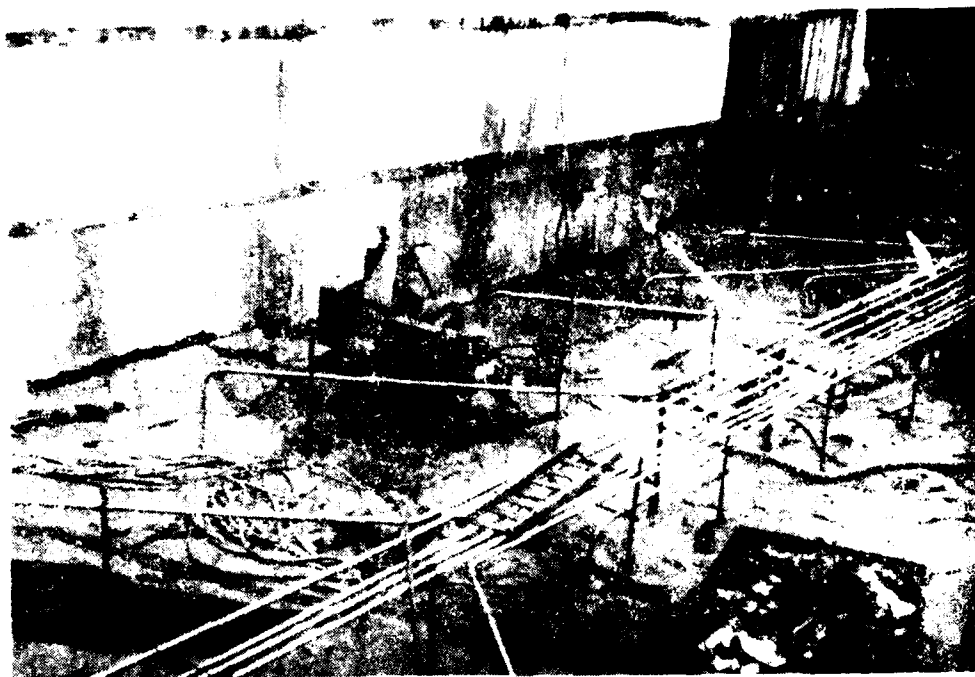


Photo 39 - Finalizing uplift cell installation, Block 7
(January 1980)



Photo 40 - Uplift cell installation, Block 10 - note future
read out-box, center (November 1979)

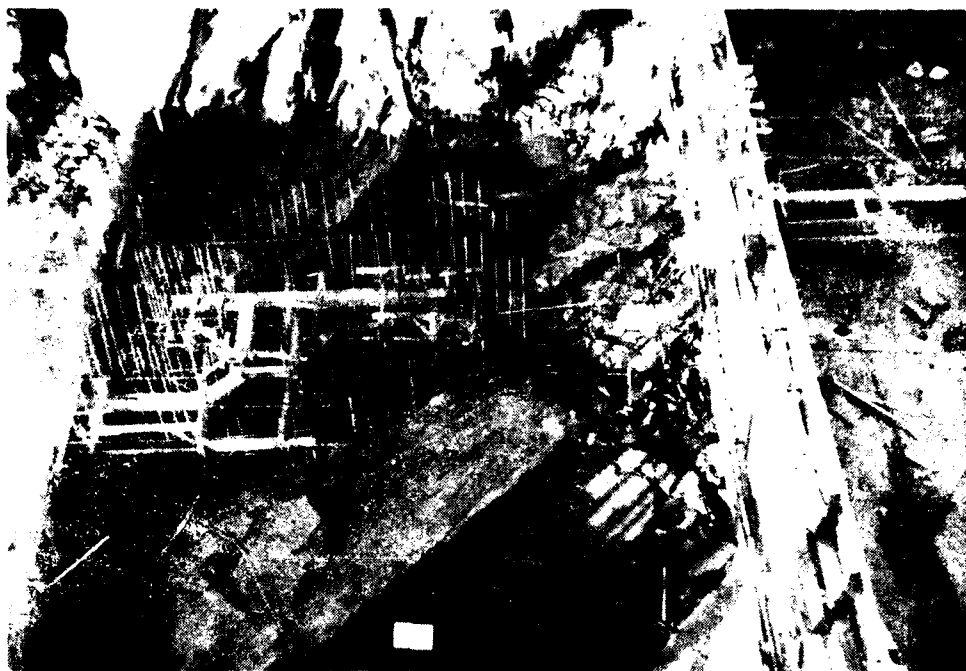


Photo 41 - Forming inspection gallery for Monolith 27. Note uplift cells in Block 28, upper right. (January 1980)

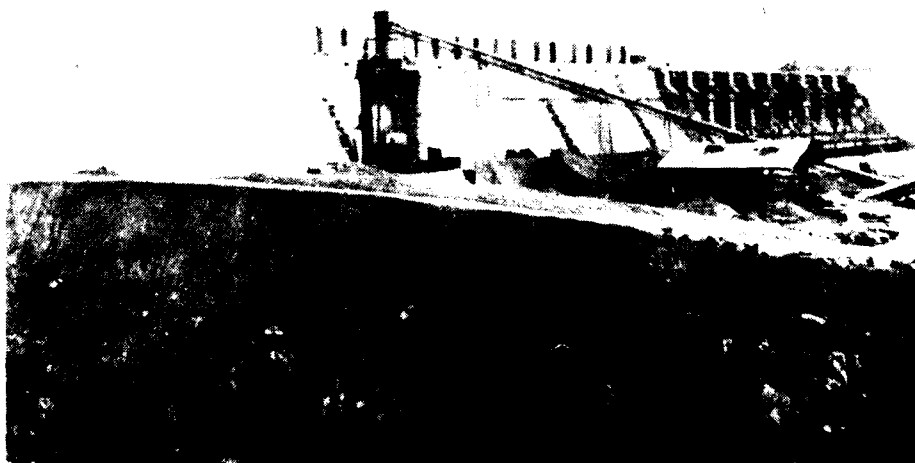


Photo 42 - Downstream side of dam after second stage diversion. (February 1982)



Photo 43 - Downstream side of dam after second stage diversion.
(February 1982)

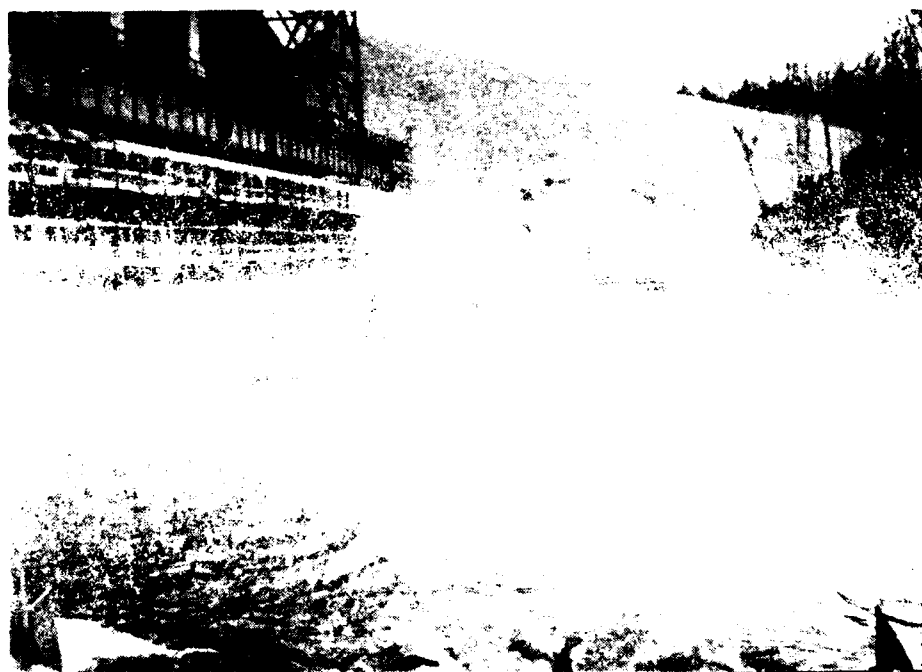


Photo 44 - Downstream side of dam after second stage diversion.
(February 1982)



Photo 45 - Upstream side of dam shortly after second stage diversion (January 1982)

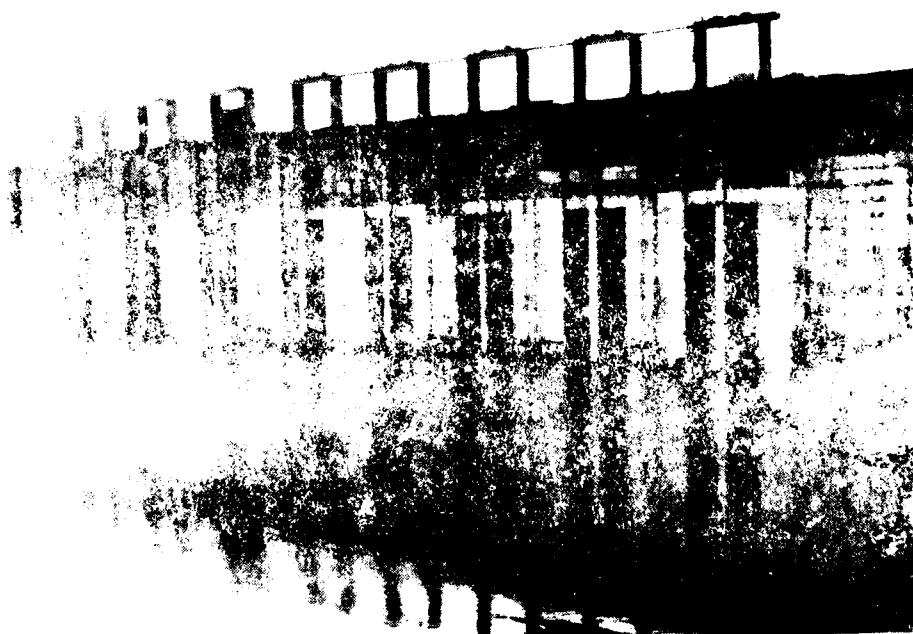


Photo 46 - Upstream side of dam (February 1982)

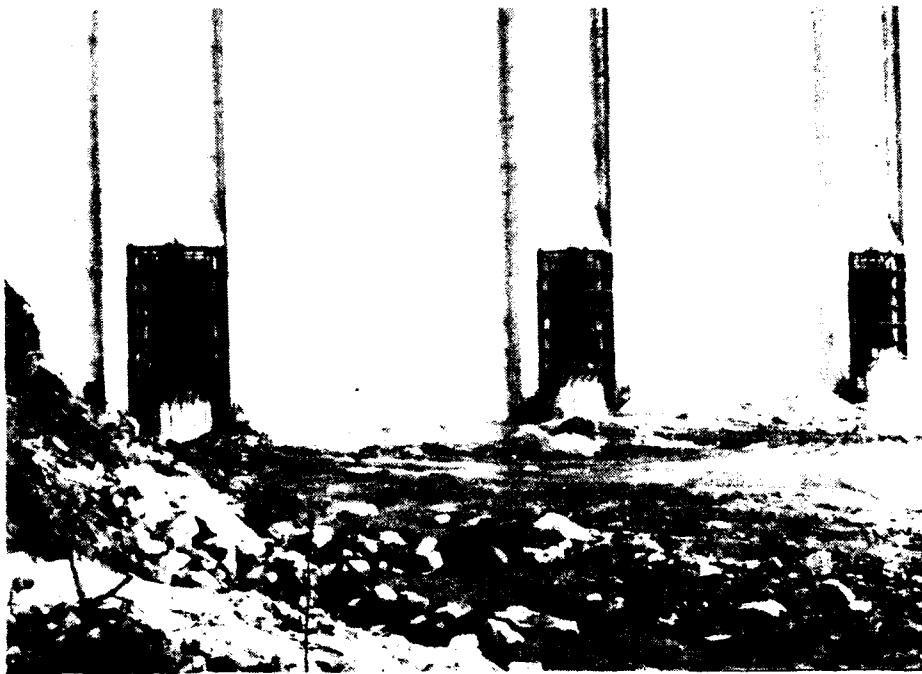


Photo 47 - Upstream side of dam - sluice entrances with stop log

CONCRETE DAM FOUNDATION PHOTOS



Photo 48 - Monolith 1 foundation (June 1979)

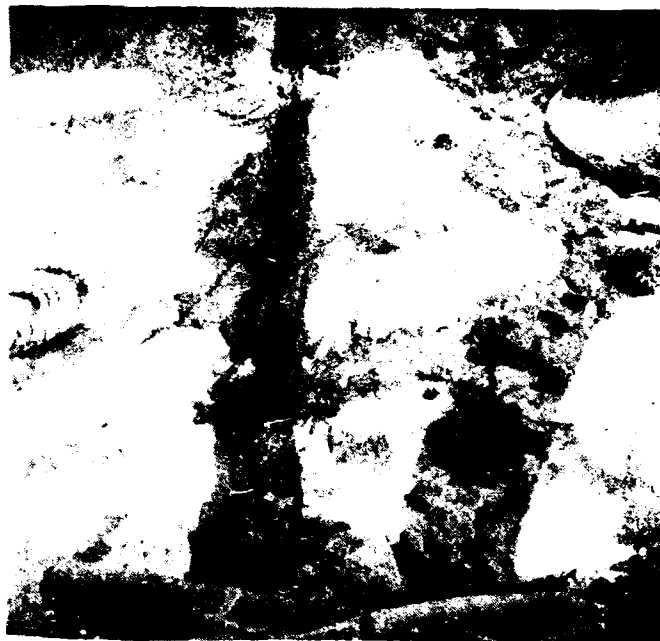


Photo 49 - Monolith 2 foundation - dike running downstream
under trestle toward upstream of Monolith 2
(April 1979)



Photo 50 - Monolith 2 foundation stress zone (April 1979)



Photo 51 - Monolith 3 foundation (May 1979)



Photo 52 - Monolith 3 foundation (May 1979)

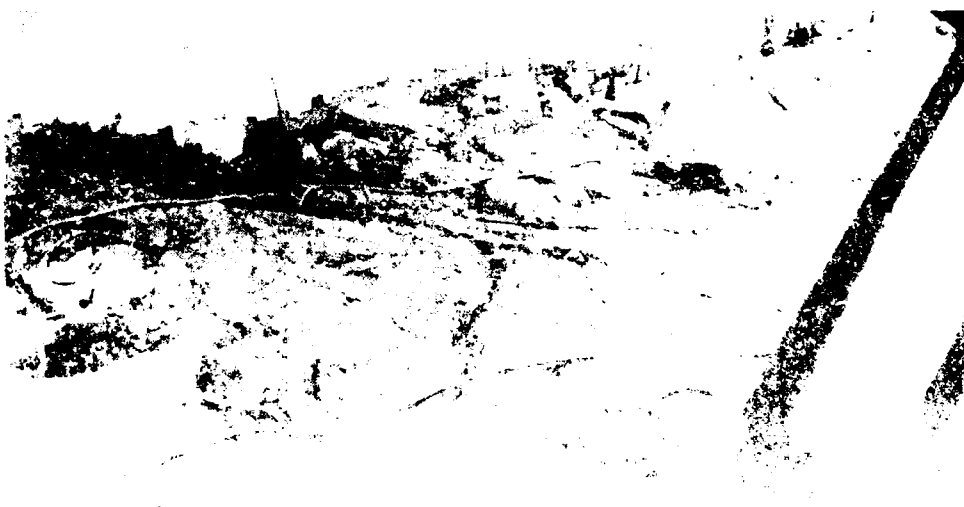
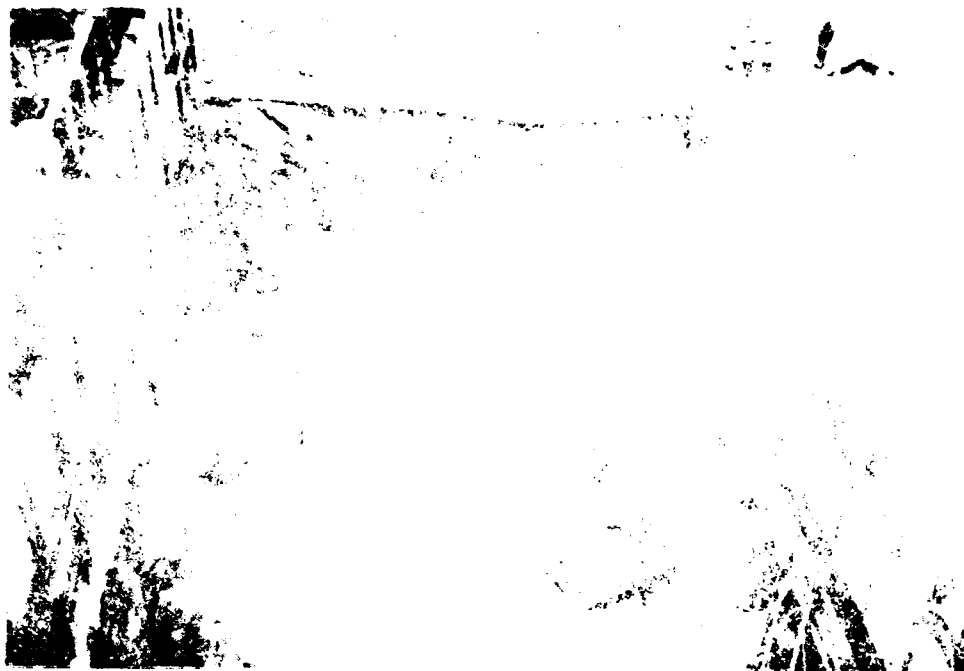




Photo 55 - Monolith 6 foundation. (May 1979)



Photo 56 - Foundation of the dike that contains rounded cobbles of felsic rock. At least one of these cobbles had an apparent bedded structure which had survived contact metamorphism and recrystallization. (March 1979)



Photo 57 - Monolith 7 foundation (December 1979)



Photo 58 - Monolith 7 foundation (December 1979)



Photo 59 - Monoliths 7 and 8 step-up face. Iron pipes are grout and drain guide sleeves. Lengths vary to provide 2"-6" of stickup into gutters in the rising galleries. (July 1979)

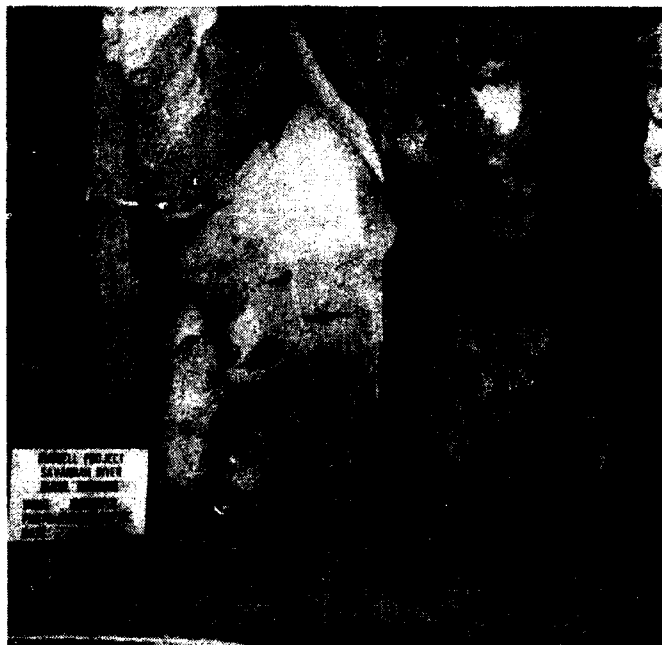


Photo 60 - Monoliths 7 and 8 step-up face (August 1979)

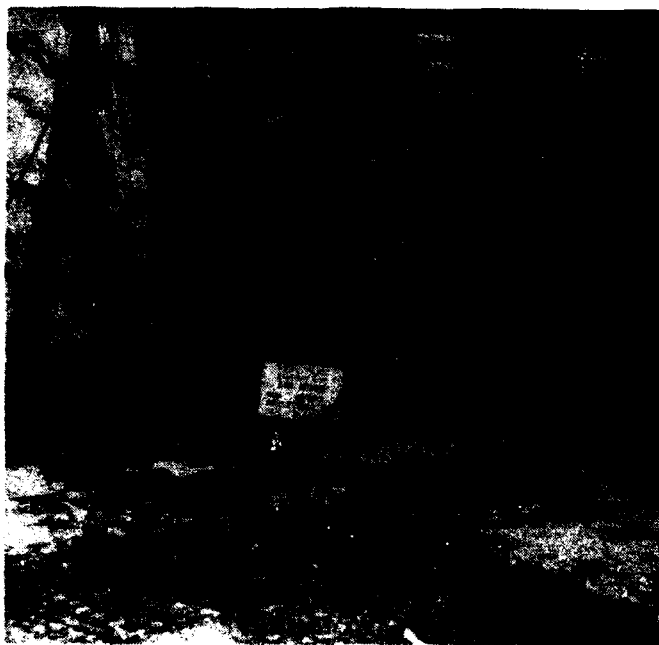


Photo 61 - Monolith 8 foundation (August 1979)

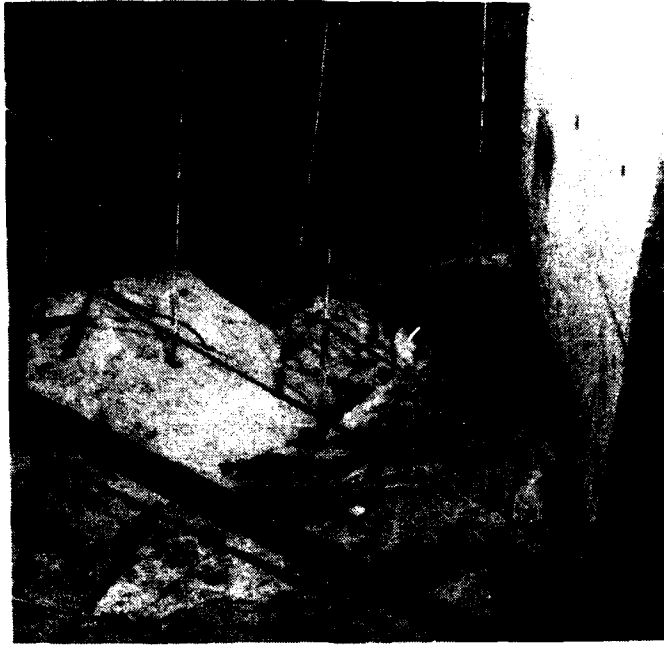


Photo 62 - Monolith 8 foundation (May 1979)

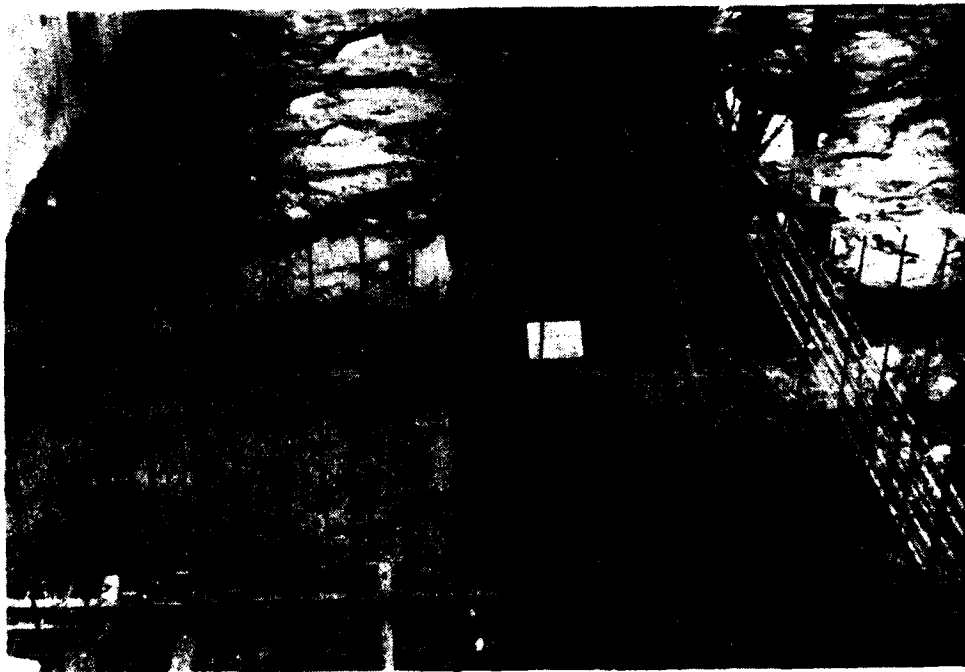


Photo 63 - Monolith 10 foundation (December 1979)



Photo 64 - Monolith 10 foundation (October 1979)



Photo 65 - Monolith 10 foundation (October 1979)



Photo 66 - Monolith II foundation (July 1-79)



Photo 67 - Monolith I foundation (July 1-79)



Fig. 1. View of the construction of the bridge.



Fig. 2. View of the construction of the bridge.

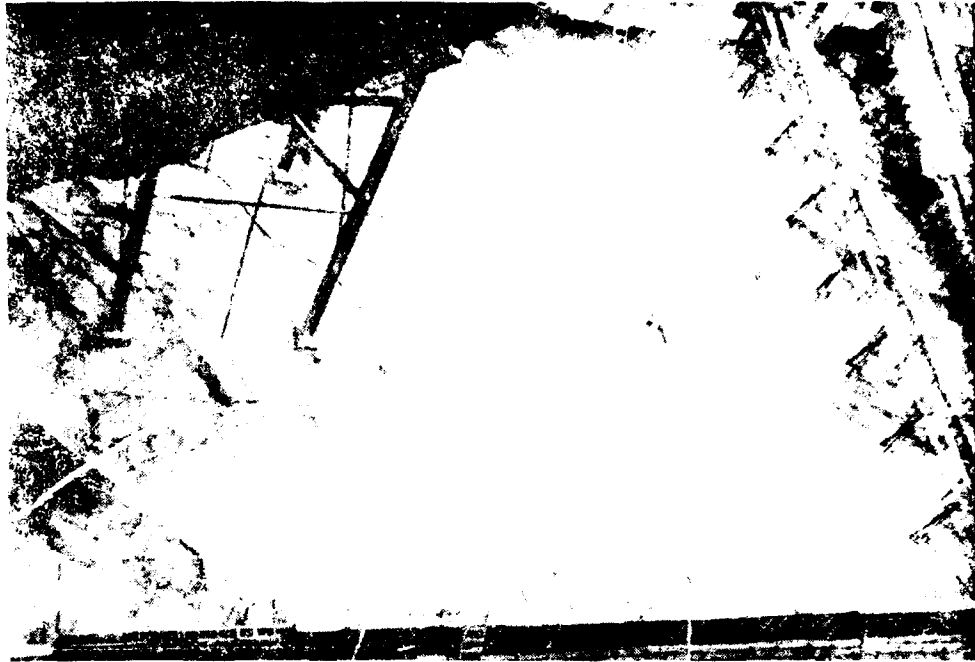


Photo 70 - Monolith 13 foundation, fault is present near middle of photo (January 1980)



Photo 71 - Monolith 13 foundation fault (January 1980)







Received 25 November 1993; accepted 16 February 1994



Figure 26. Map of the study area showing the location of the study sites. The map shows the location of the study sites (1-10) relative to the city of Lima, Peru. The map also shows the location of the city of Lima, Peru, and the location of the study area.

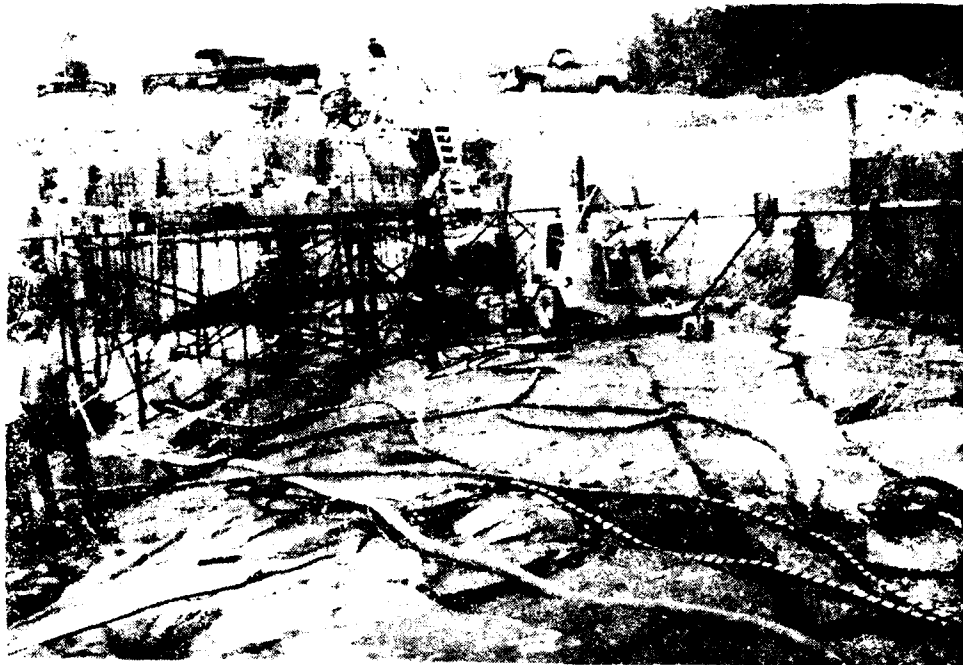


Photo 77 - Monolith 19 foundation (August 1979)



Photo 78 - Monolith 19 foundation (August 1979)

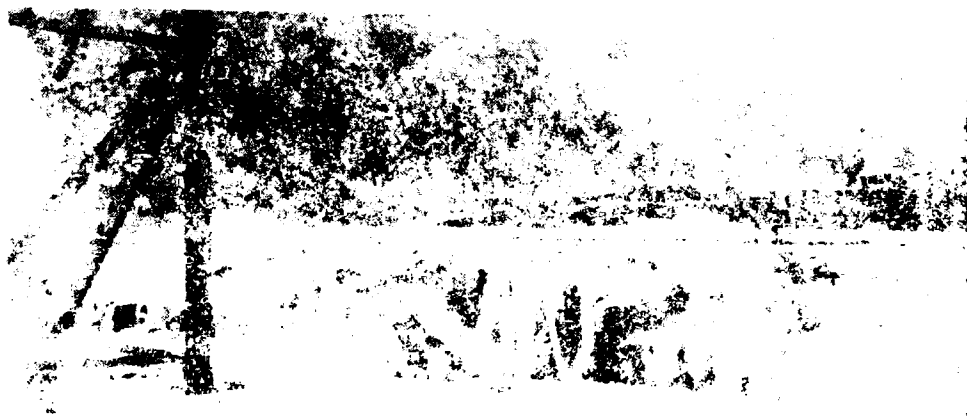
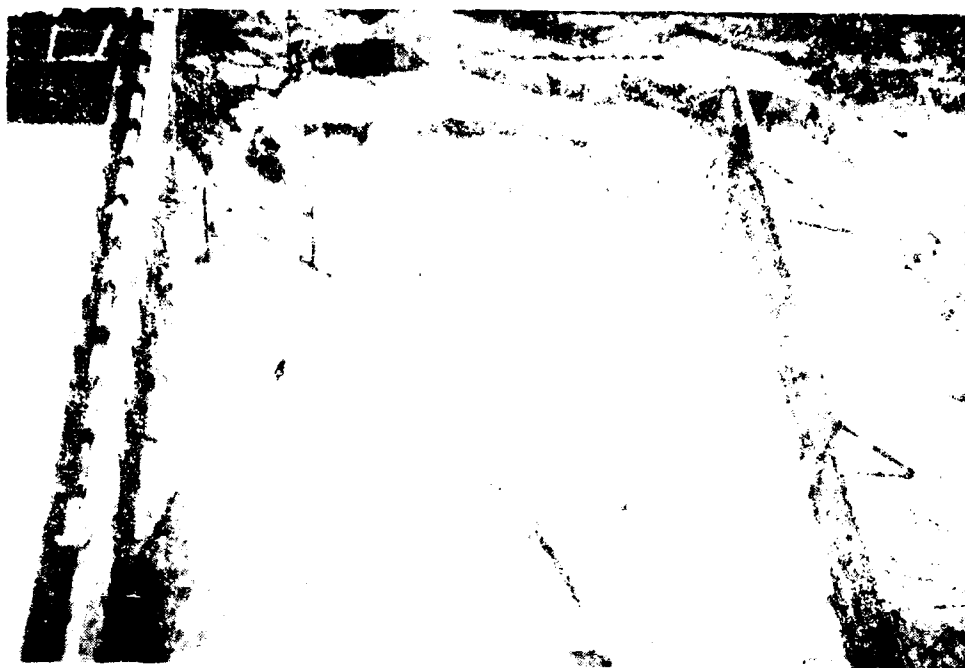






Photo 83 - Monolith 22 foundation (December 1979)



Photo 84 - Monolith 23 foundation grouting (November 1979)



Photo 85 - Monolith 23 foundation (February 1980)



Photo 86 - Monolith 25 foundation (April 1980)



Photo 87 - Monolith 26 Foundation (September 1979)

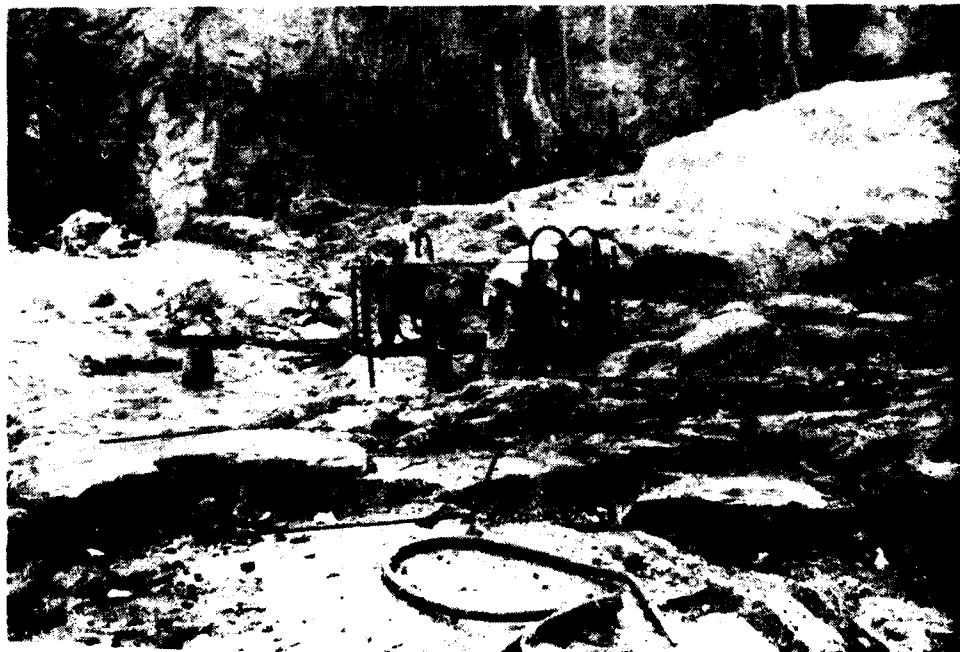


Photo 88 - Monolith 26 - Installation of rebar basket on footer foundation (September 1979)



Photo 89 - Monolith 27 foundation (January 1980)



Photo 90 - Monolith 27 foundation (January 1980)



Photo 91 - Monolith 25 Foundation (November 1969)



Photo 92 - Monoliths 28/29 Step-up (March 1970)



Photo 93 - Monoliths 28/29 Step-up face (February 1980)



Photo 94 - Monolith 29 foundation



Photo 1 - Monolith foundation - 2nd floor corner (July 1980)



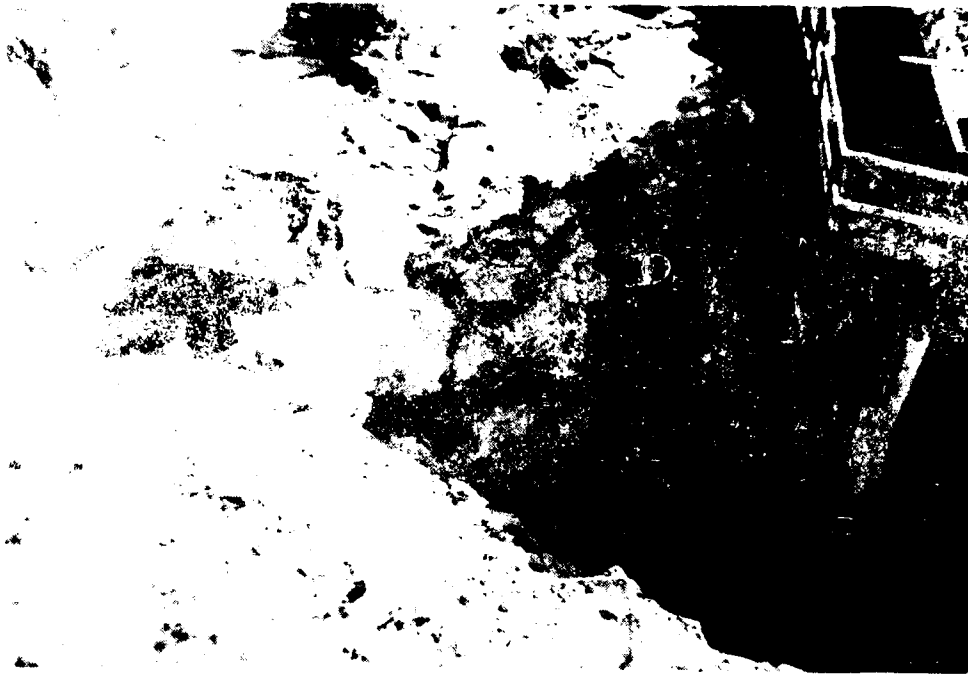


Photo 97 - Monolith 11 Foundation (October 1980)

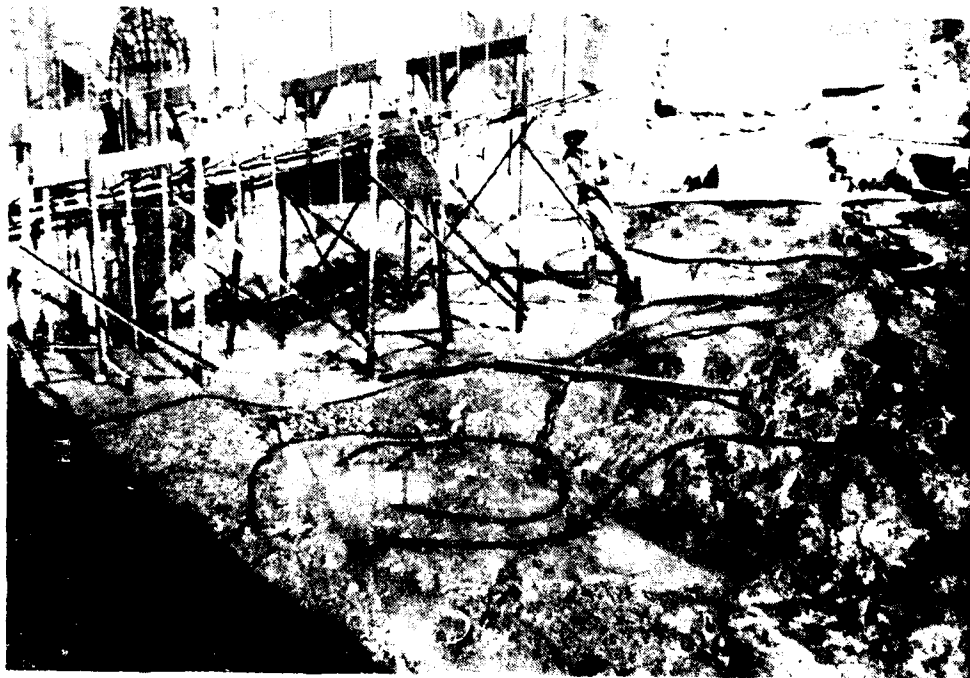


Photo 98 - Foundation of the top of the



Photo 99 - Monolith 32 foundation - looking east (February 1981)

GROUTING INSIDE GALLERY

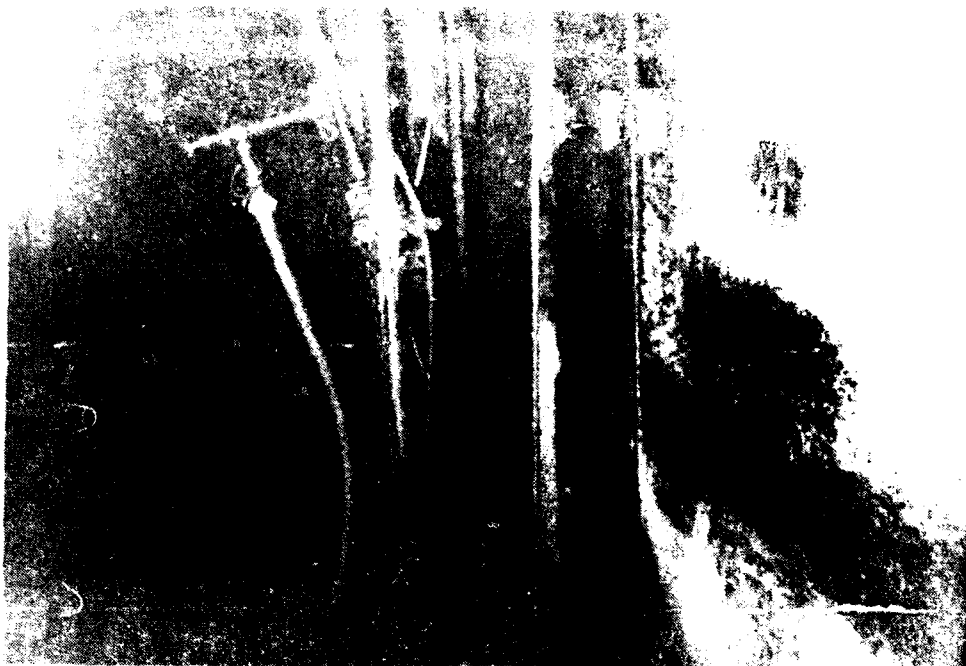


Photo 100 - Chicago pneumatic CP-65 drilling grout hole.
(October 1981)



Photo 101 - Chicago pneumatic CP-65 drilling grout hole.
(October 1981)



Figure 1. A photograph of the dark, rectangular object, possibly a door or a large container, set against a lighter, textured background.



Figure 2. A photograph of a dark, curved object, possibly a pipe or a hose, with a lighter, textured surface.



Photo 104 - Block 27 gallery floor grout communication with
hole at Station 16 + 91 (August 1981)

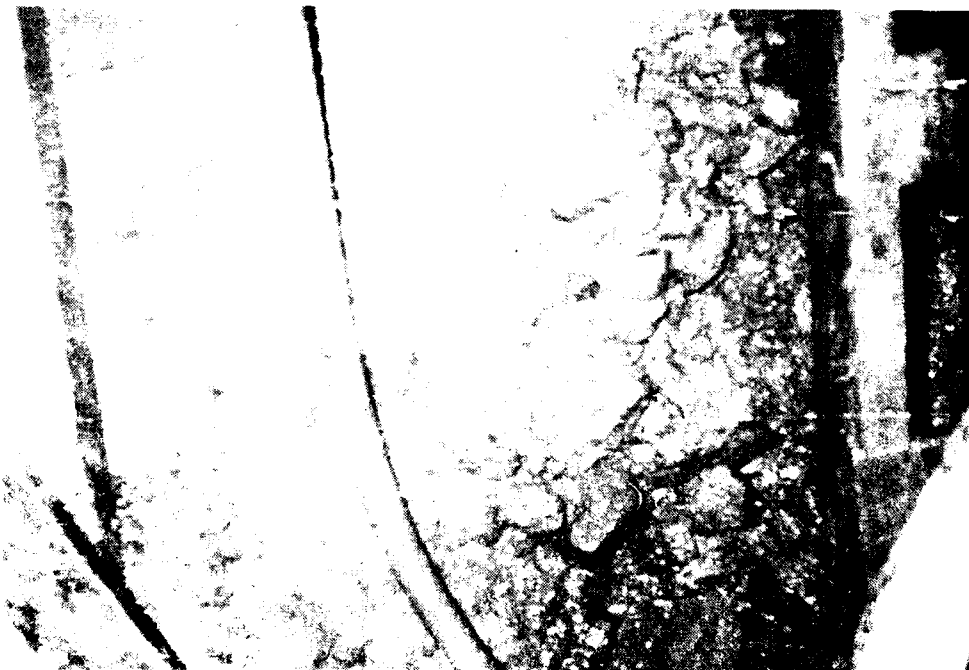


Photo 105 - Block 27 gallery floor grout communication with
hole at Station 16 + 91 (August 1981)

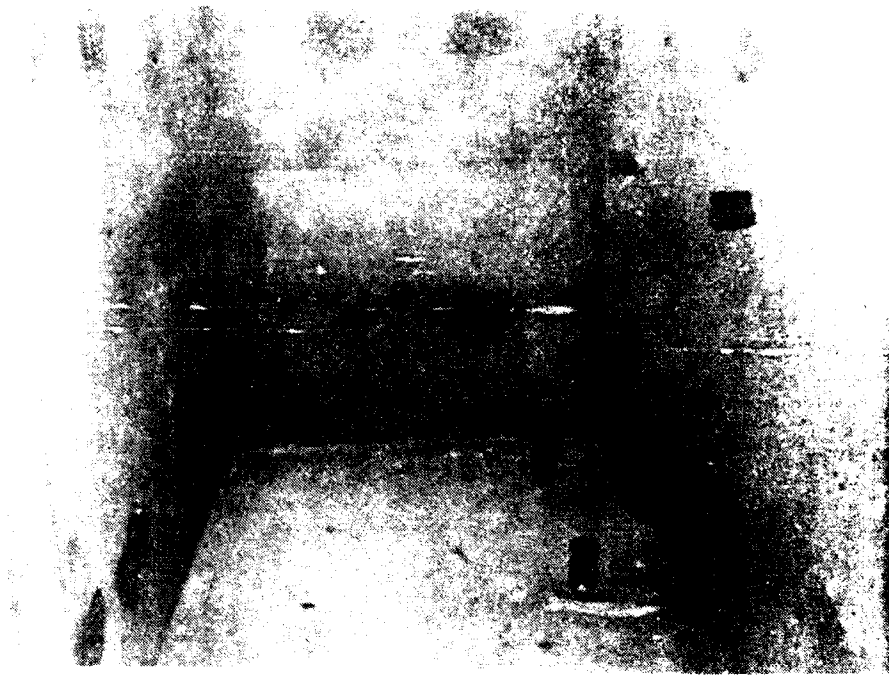


Photo 106 - Inspection gallery grouting - Block 15 (August 1981)



Photo 107 - Inspection gallery grouting - Block 15 (August 1981)

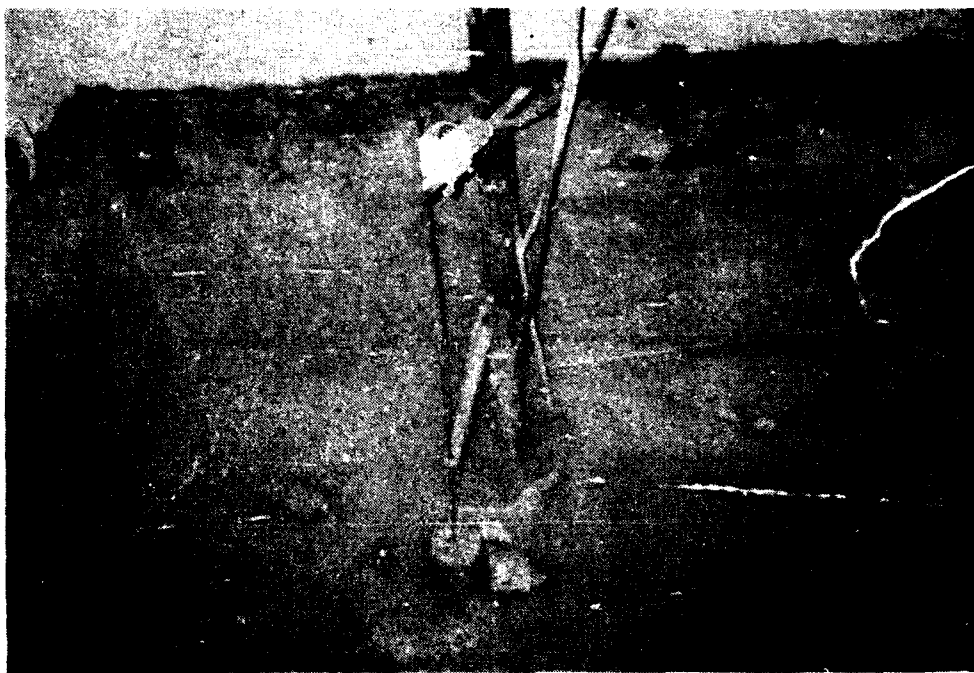


Photo 108 - Sump pump with automatic float devices (October 1981)

POWERHOUSE PHOTOS



Photo 109 - Power excavation (May 1979)



Photo 110 - Powerhouse excavation - note "noses", drainage sump (filled with water) and draft tube tailrace slope 1 on 5. (February 1980)



Photo 111 - Powerhouse excavation - erection bay area and
Unit #1. (February 1980)



Photo 112 - South wall, erection bay looking east (1980)

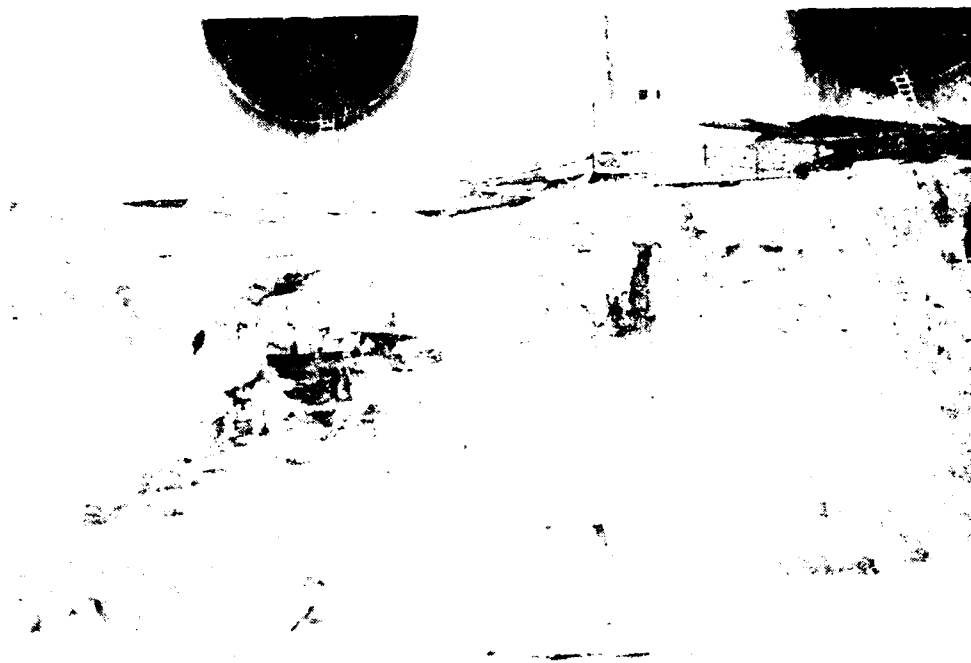


Photo 113 - Powerhouse excavation (May 1981)





Photo 115 - Powerhouse excavation (May 1981)



Photo 116 - Powerhouse excavation (May 1981)



Photo 11 - view of the embankment at the entrance to the
 intake tunnel. The embankment is composed of
 talus. The presence of talus indicates that the
 overflow and the below design grade elevation of
 600 and 610 ft. (Fig. 10b).

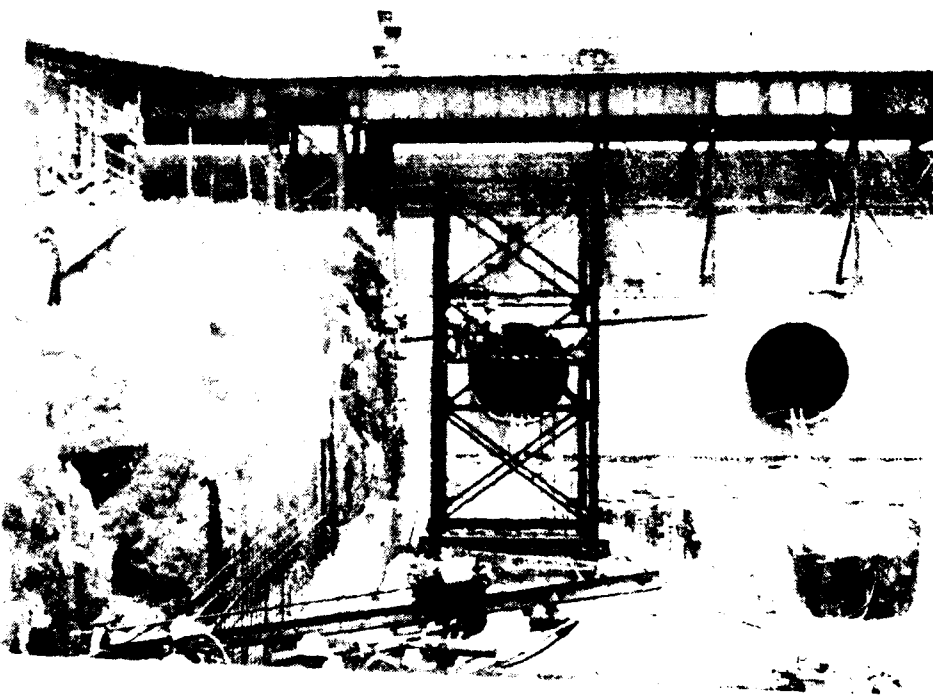


Photo 12 - gate structure at the entrance to the intake
 tunnel.

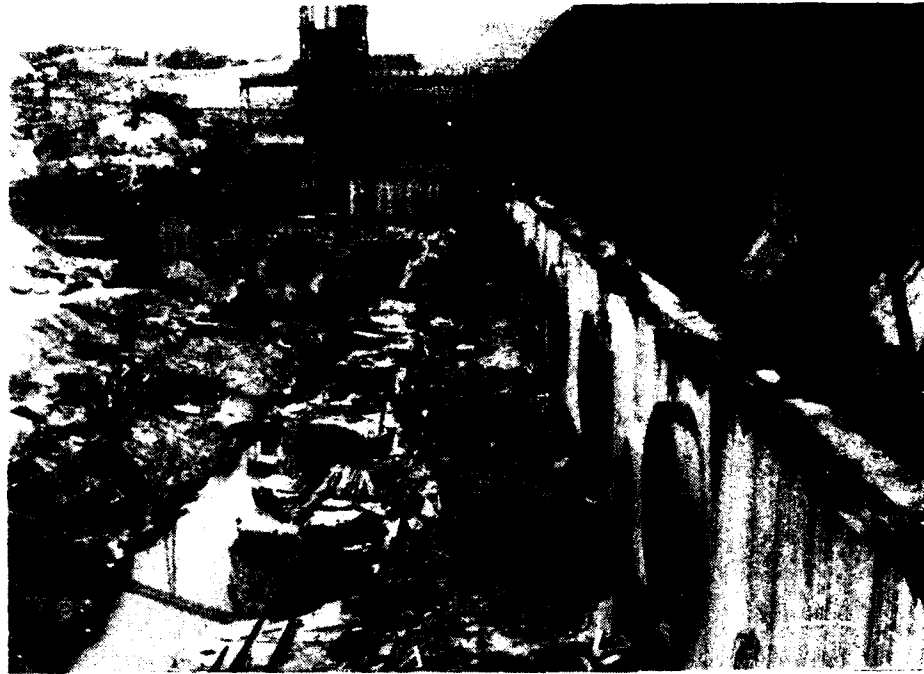


Photo 119 - Powerhouse excavation - viewing west. Note tailrace hang-on wall and erection bay substructure in top left quadrant of photo. (October 1981)



Photo 120 - Powerhouse excavation - viewing east (April 1981)



Photo 121 - Powerhouse excavation, taken immediately after

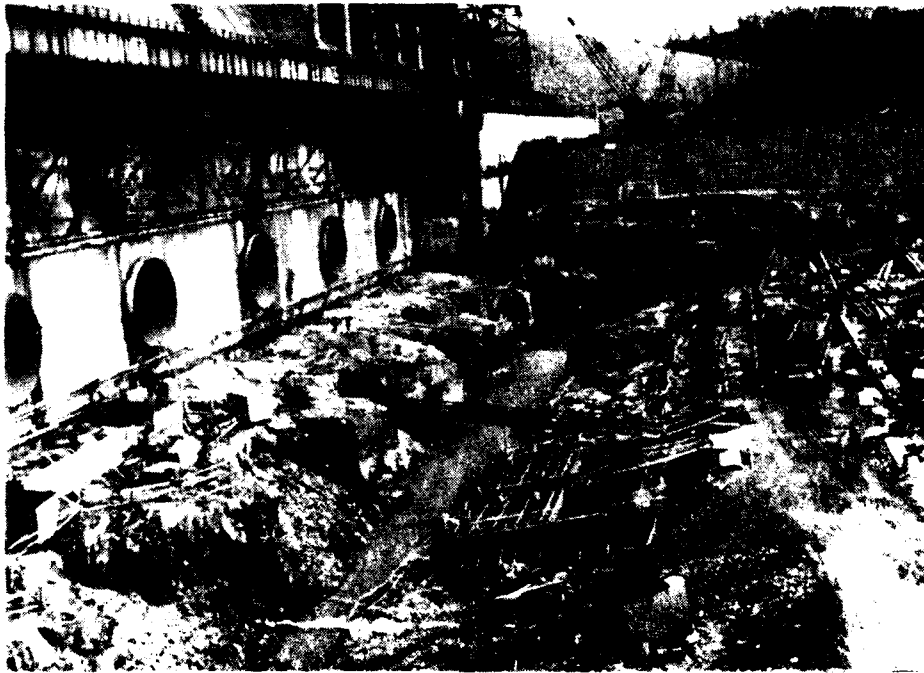


Photo 122 - Powerhouse excavation, taken immediately after
the completion of the excavation work.

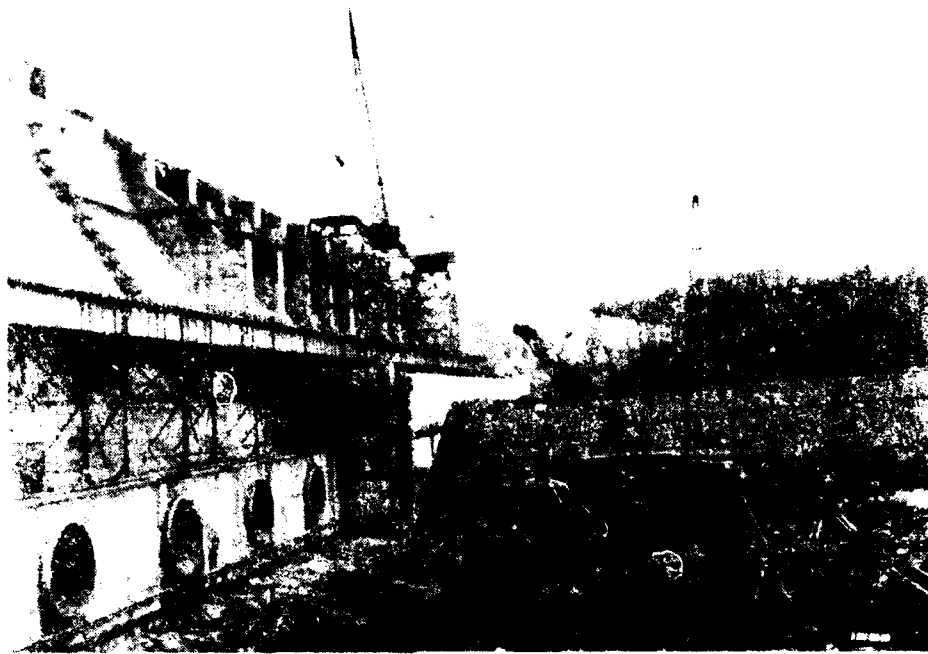


Photo 123 - Powerhouse area - immediately after second stage diversion. (January 1982)



Photo 124 - Powerhouse "pools" (January 1982)

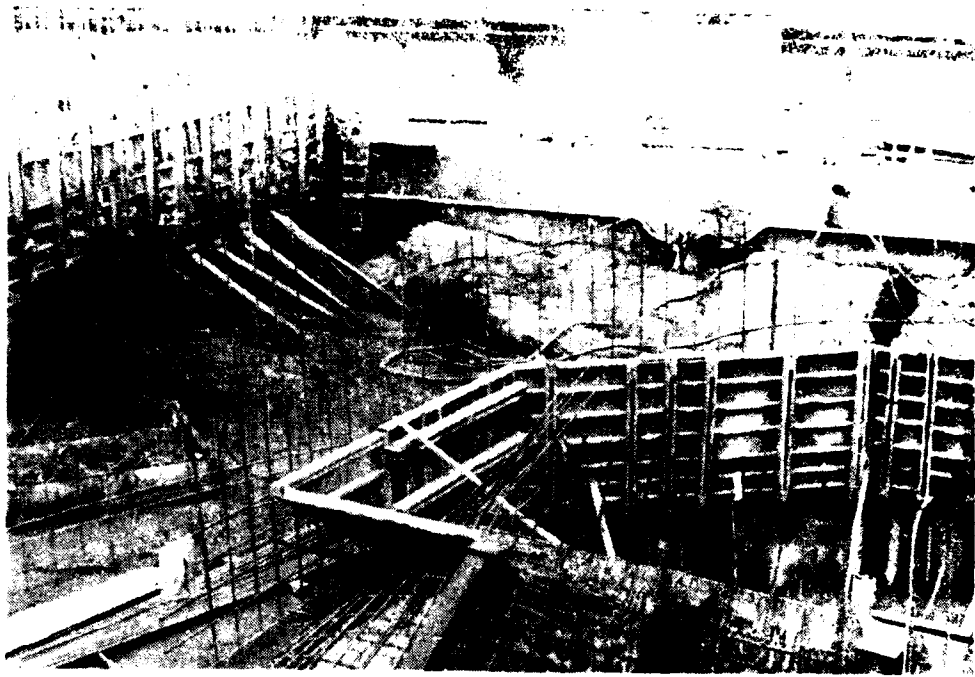


Photo 125 - Powerhouse Unit #2 (1982)

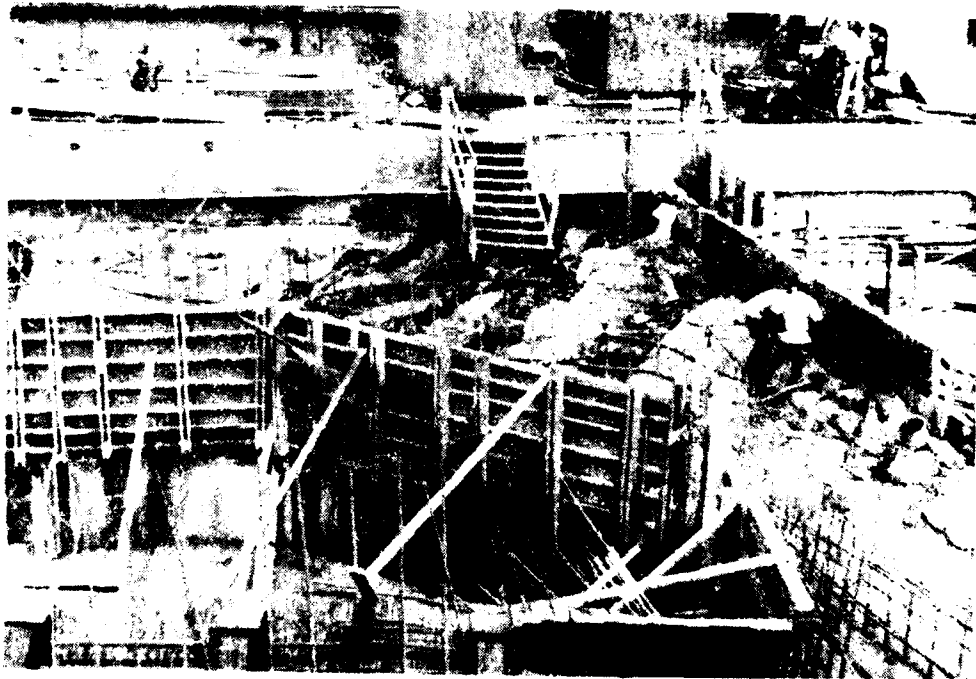


Photo 126 - Powerhouse Unit #2 (1982)



Photo 127 - Powerhouse foundation - vicinity of Unit #2 (1982)

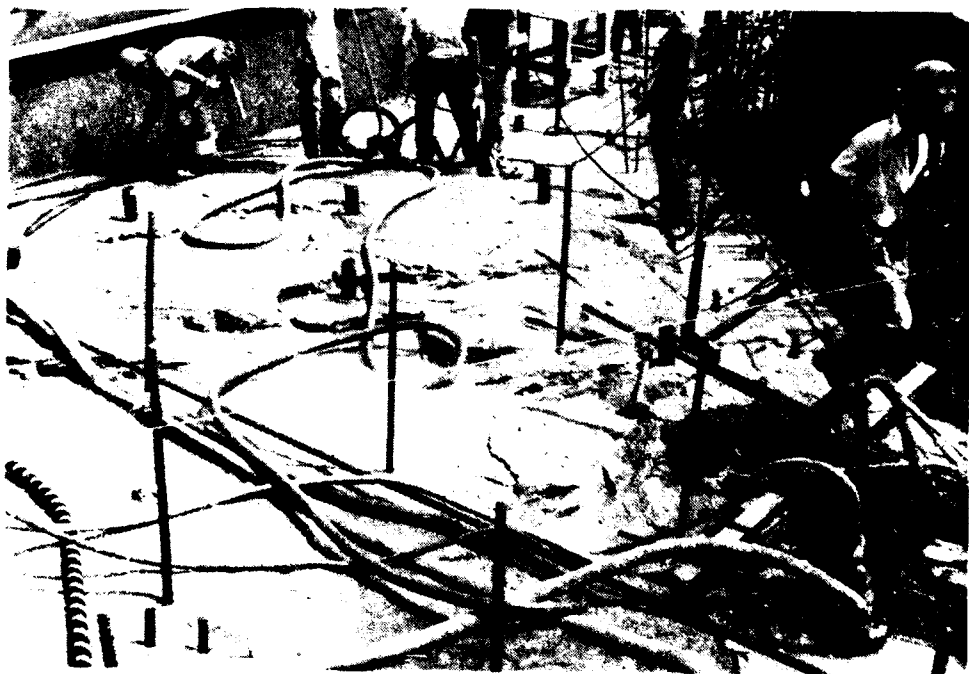


Photo 128 - Powerhouse foundation - vicinity of Unit #2 (1982)



Photo 129 - Drilling foundation relief drains - draft tube area.(1982)

GEORGIA WEST EMBANKMENT PHOTOS



1. View from forest - same area looking east of bridge to



2. View from forest - same area looking east of bridge to



Photo 134 - Pressure washing with communication. These pipes extend 20-40 feet down through overburden and the communication is probably at the overburden/rock contact. (February 1980)



Photo 135 - Cross-section of trench during Class I excavation. (December 1979)



Photo 136 - Foundation conditions, Georgia west - approximately Stations 9+00 to 10+00. Some additional excavation was done in this area.



photo 17 - Foundation conditions - Stations 9 + 00 to 10 + 00



photo 18 - Foundation wall embankment - Station 10 + 00



Photo 139 - Mixing grout in Georgia west grout area (February 1980)



Photo 140 - Georgia west excavation - approaching diversion channel foreground (April 1980)



Photo 141 - Cross-dike treatment at Station 7+85.



Photo 142 - Crout leaks at Station 12+10. Note gray streaks in center of photo where thin grout ran over the stairssteps.



Photo 143 - Foundation on iron ... from west embankment.



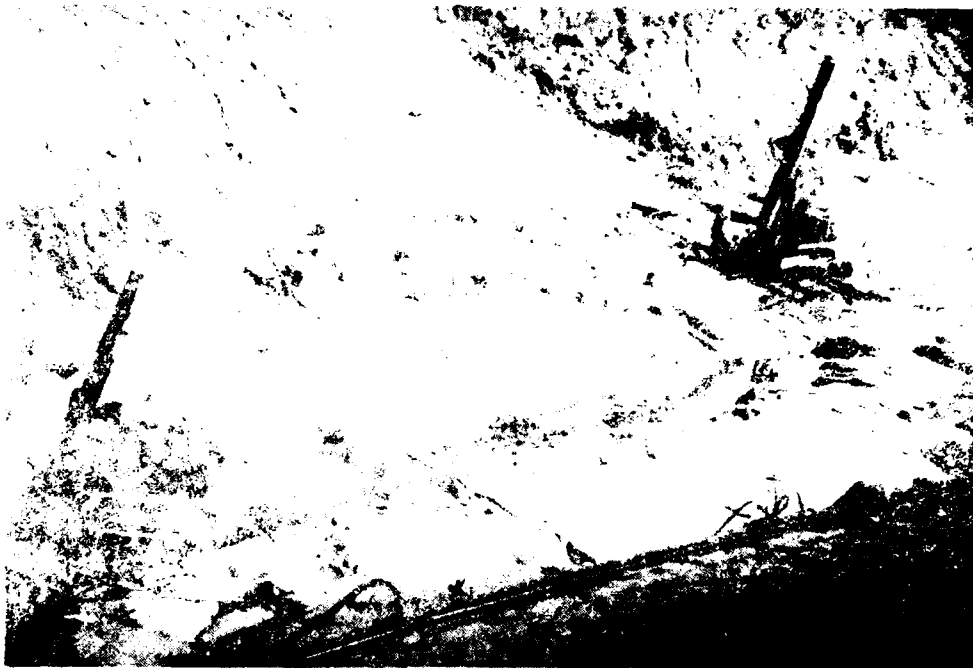


Photo 145 - Line drilling grout holes in Georgia embankment - Note 20° west inclination.



GEORGIA WEST EMBANKMENT - "BATHTUB" AREA PHOTOS



Photo 147 - "Bathtub" prior to perimeter hole layout



Photo 148 - "Bathtub" prior to perimeter hole layout

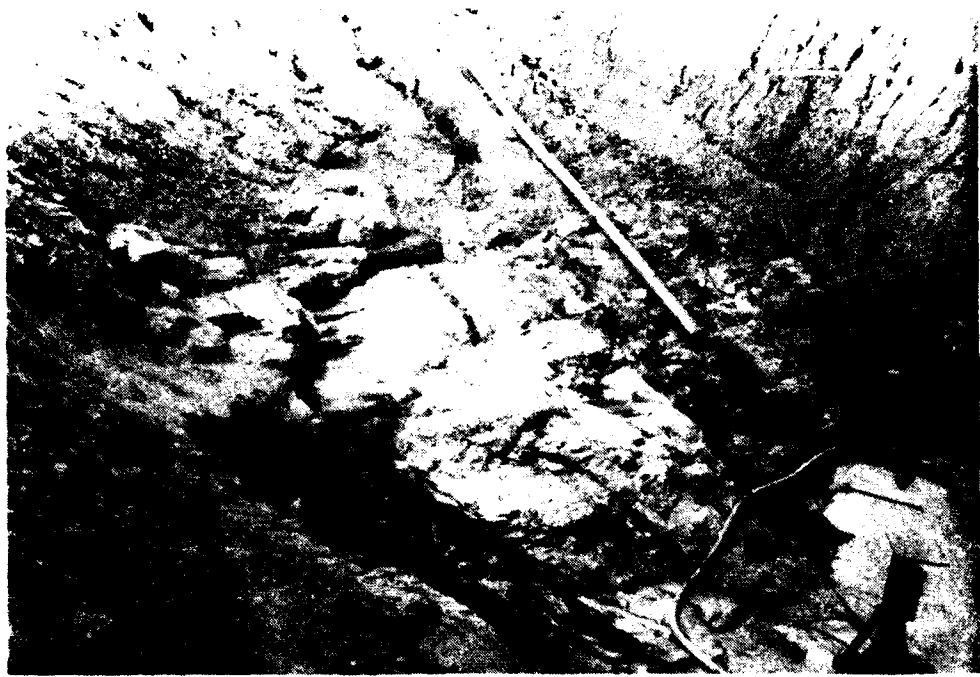


Photo 149 - "Bathtub" treatment

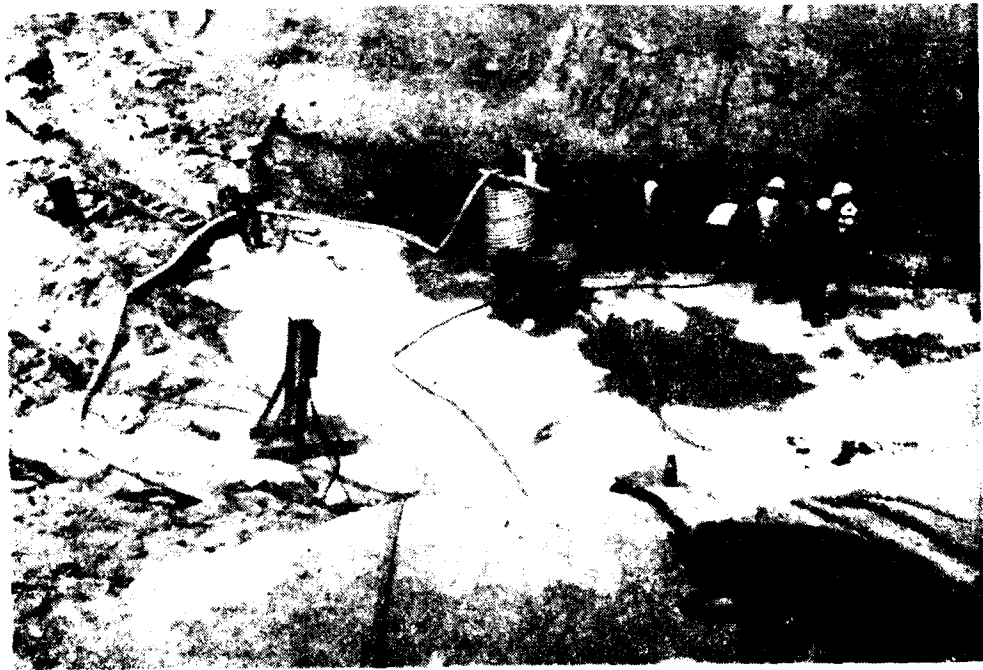


Photo 150 - "Bathtub" treatment



Photo 151 - "Bathrub" treatment - compaction coarse filter
around area after concrete placement.



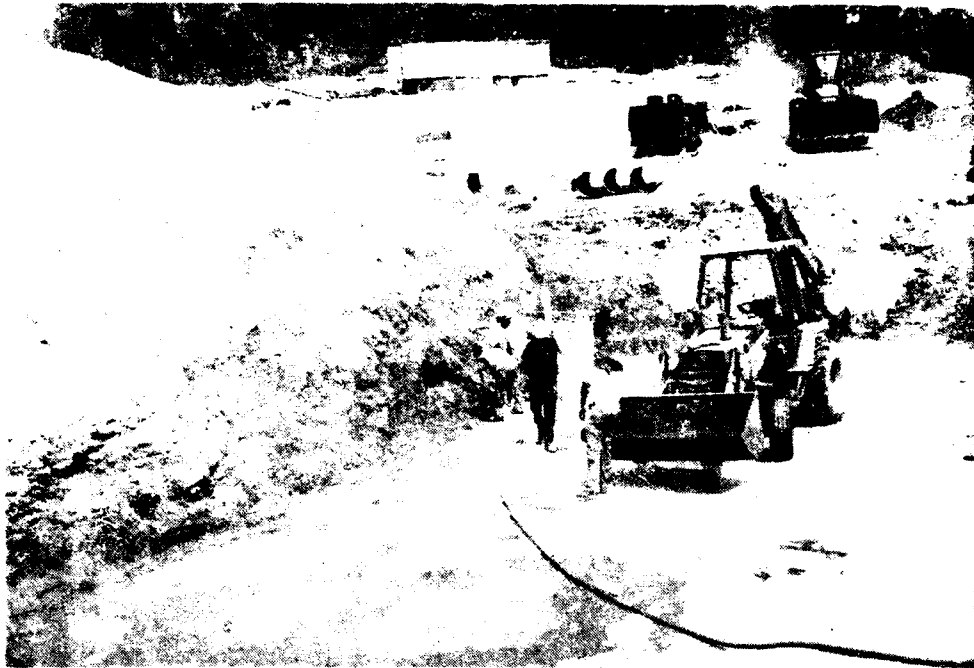


Photo 153 - "Bathtub" treatment - setting coarse sand filter after concrete placement.



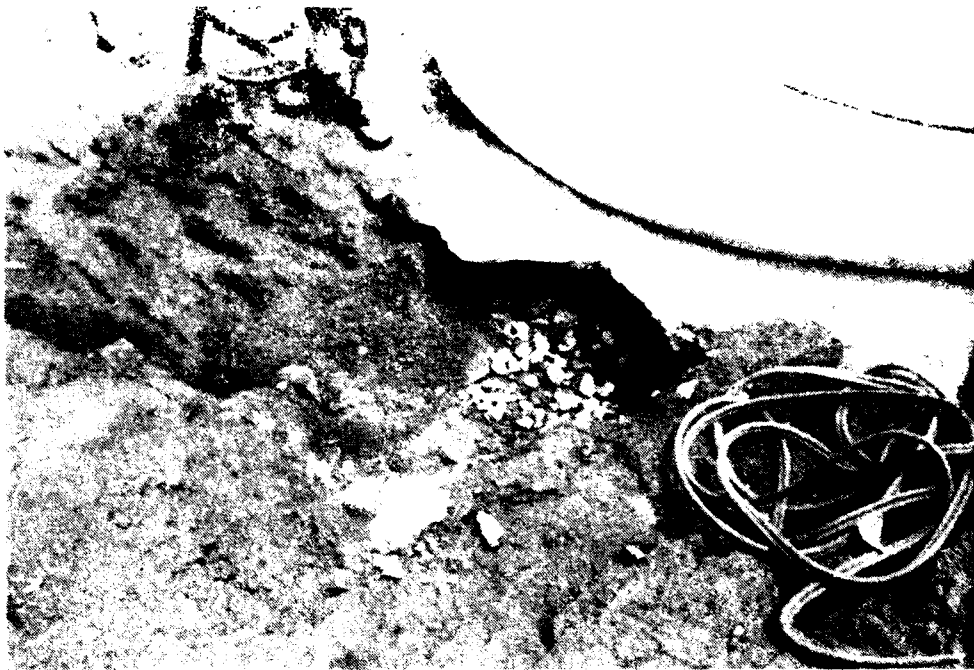


Figure 1. "X-ray" view of the site. The image shows the site of the investigation, which is a rocky, uneven terrain. The image is a black and white photograph.



Photo 157 - "Bathtub" treatment - placing concrete by hand.

GEORGIA EAST EMBANKMENT PHOTOS



Photo 15a - Excavation of broken material in Moonlith 5 near joint with Moonlith 4. Material has not been blasted (September 1978).

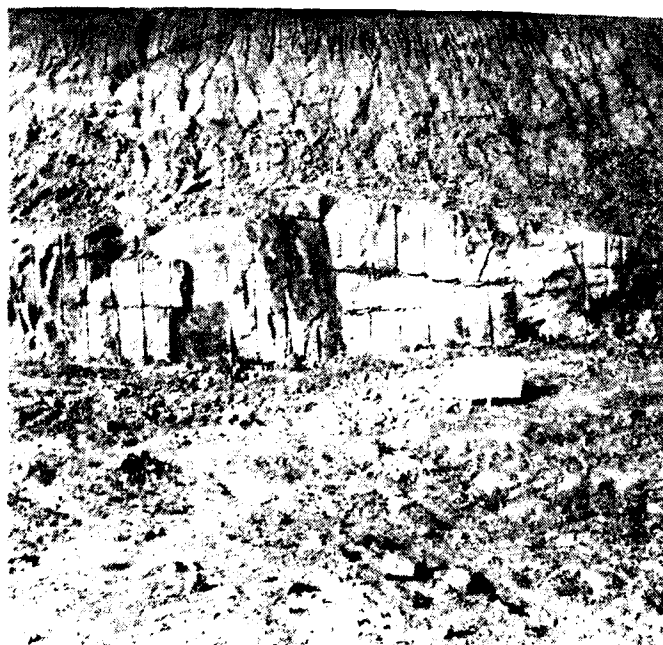




Photo 160 - Georgia east embankment cleanup. Note quarry operation in background.



Photo 161 - Georgia east embankment cleanup. Note quarry operation in background.



Figure 10 - Georgia coast - dune - note Monolith at right
(Station 2 + 00 - 21 + 00)



Figure 11 - Georgia coast - after storm - note
200 ft. post markers at right
(X 100 ft. 1950)

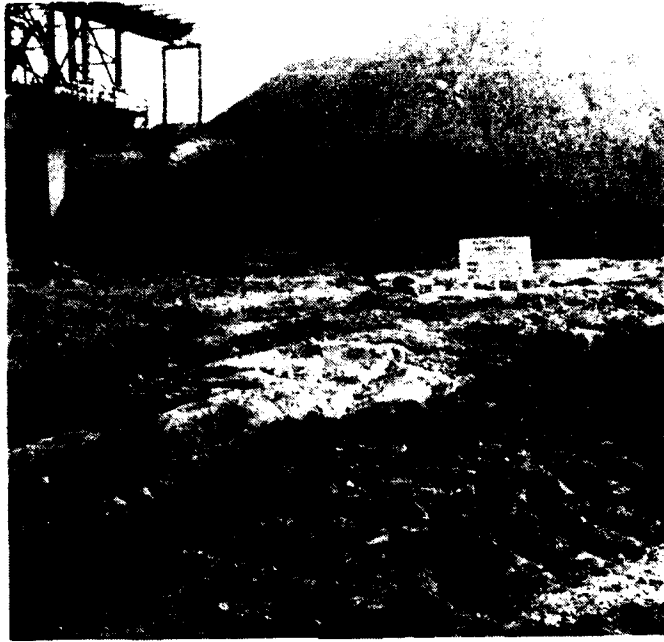


Photo 164 - Georgia east abutment downstream of Monolith 4
(October 1978)



Photo 165 - Washing of Georgia abutment for consultation with
OCE, SAD, and SAS. (September 1978)



Photo 166 - Mud seams exposed downstream of Monolith 2. Note lens cap just over joint. (August 1978)



Photo 167 - Georgia abutment Monoliths 3-7 after cleaning by machines. (October 1978)



Photo 168 - Georgia embankment downstream Monolith 6



Photo 169 - Georgia east embankment downstream Monolith 2



Photo 170 - Georgia east looking west at the
Station 22 + 60 (January 1981)

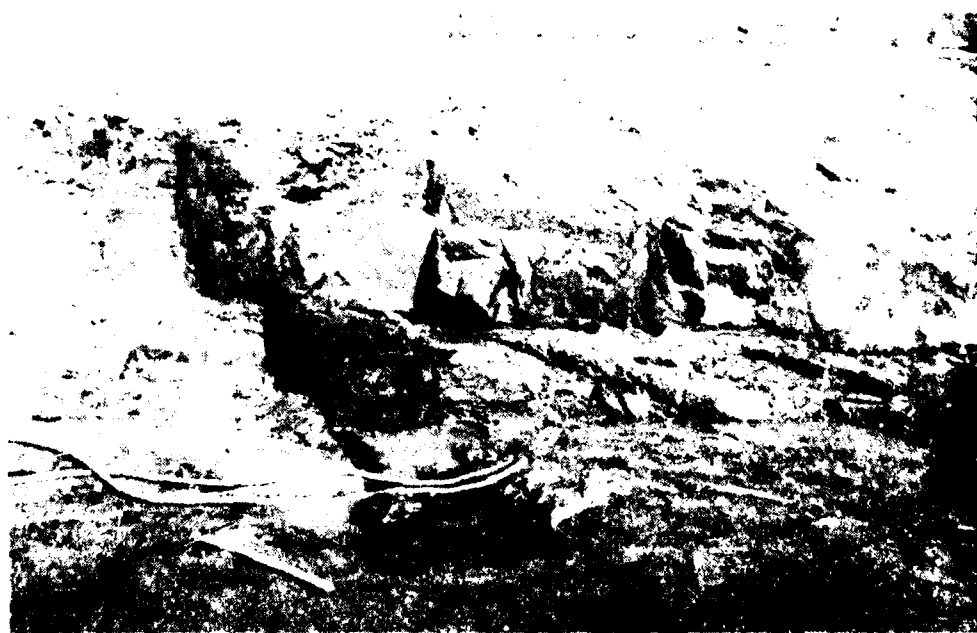


Photo 171 - Georgia east looking downstream at Station
22 + 60 (January 1981)



Photo 172 - Problem below Georgia east bluff in grouting area.



Photo 173 - Problems below Georgia east bluff in grouting area.

SOUTH CAROLINA EMBANKMENT PHOTOS



Figure 1. A large, light-colored, rectangular object, possibly a piece of machinery or a large container, positioned on a dirt or gravel surface.



Figure 2. A large, dark, irregularly shaped object, possibly a piece of machinery or a large container, positioned on a dirt or gravel surface.

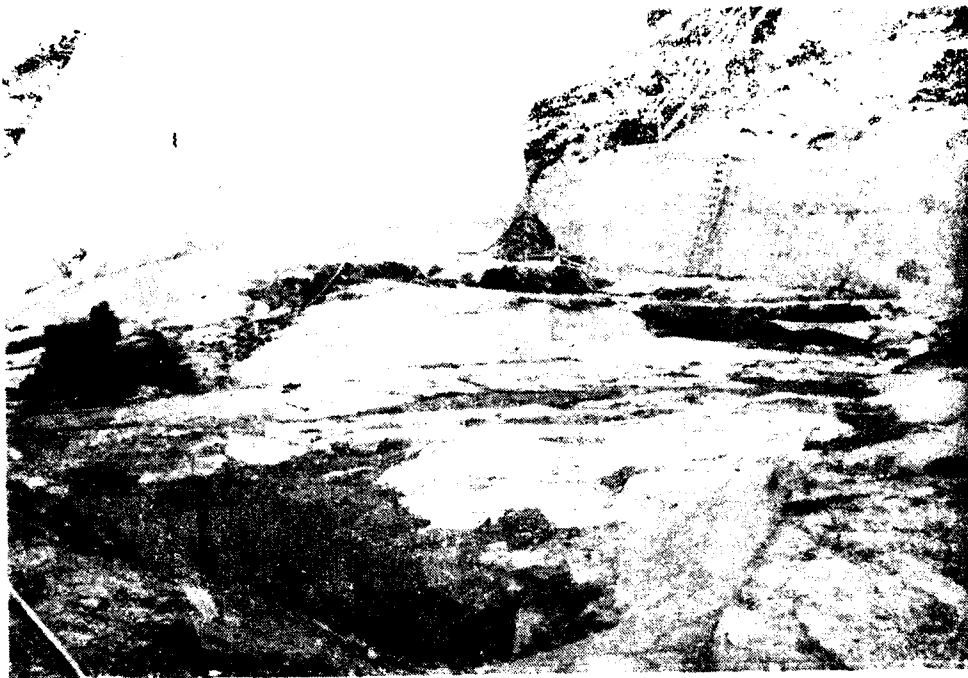


Photo 176 - South Carolina embankment foundation.



Photo 177 - "Monolith 33" and South Carolina embankment foundation.



Photo 178 - "Monolith 33" and South Carolina embankment foundation.



Photo 179 - South Carolina embankment plug downstream of dam.



Photo 180 - South Carolina plug area downstream of concrete dam.





Photo 182 - Excavation in South Carolina abutment





Photo 184 - South Carolina embankment foundation - (11/1/54)

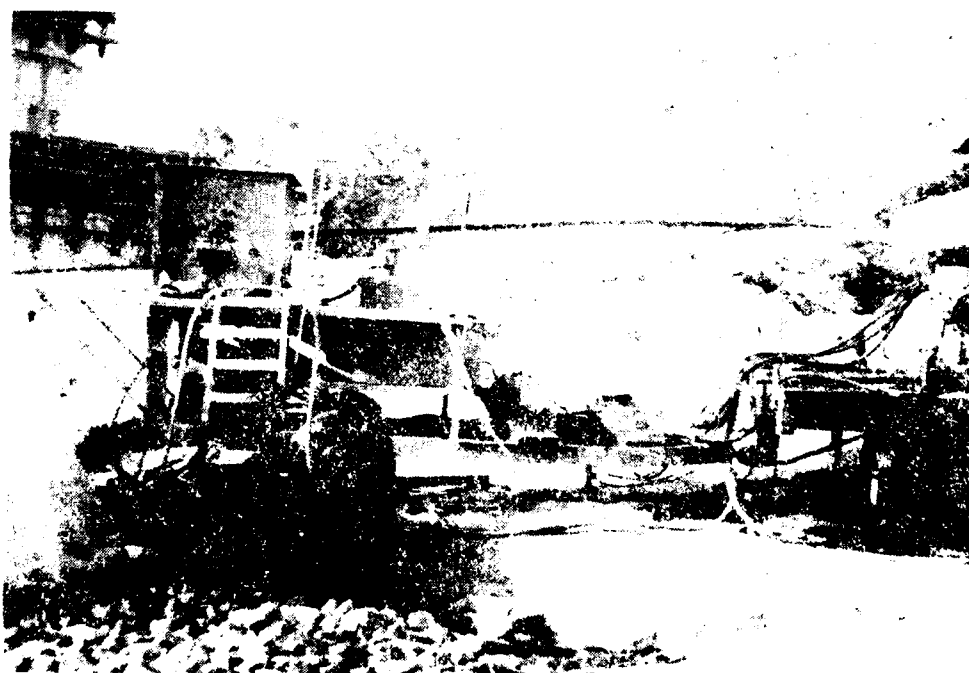


Photo 185 - Front view of South Carolina embankment



Photo 186 - Grout plant - South Carolina embankment.

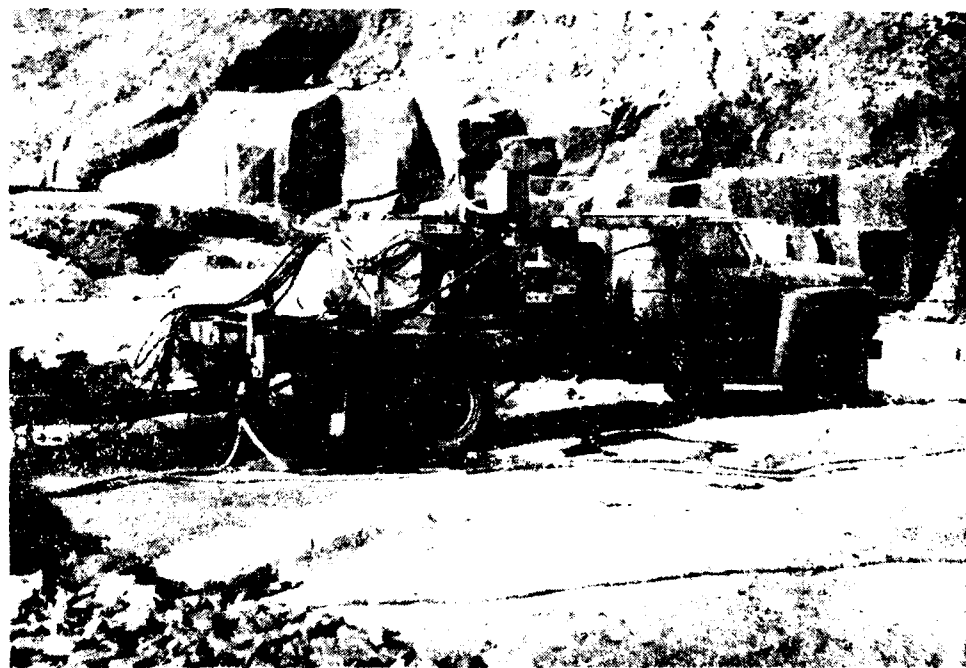


Photo 187 - Grout plant - South Carolina embankment.



Photo 188 - Drilling grout holes on the A-Line, South Carolina embankment.



Photo 189 - Drill water leaks from rock downstream of dam centerline near 30/31 Monolith joint. Communication with grout hole 18+03 was observed in this area (August 1981)